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Physical Activity Promotion from the Social Cognitive Theory Perspective: An Examination of Mobile Fitness Apps

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PHYSICAL ACTIVITY PROMOTION FROM THE SOCIAL COGNITIVE THEORY
PERSPECTIVE: AN EXAMINATION OF MOBILE FITNESS APPS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The School of Social Work

by

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This dissertation is dedicated to my wife, Jolie, and my son Caleb
Jolie, without your support, confidence, and understanding this accomplishment would
not have been possible. Thank you for allowing me to reach for the stars.
Caleb (and your future brother/sister), you have been in the forefront of my mind since I
started this journey. My goal is, and has always been, to give you a better start at life than
I have had.

I only hope I can make you as proud as you both make me each day.

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ABSTRACT

The current study has expanded the scientific understanding of physical activity motivation through the use of smartphone mobile technology. With the emergent popularity of social media, software developers have begun incorporating components of social media into mobile fitness apps, which allow users to easily engage with peer support networks to obtain motivation for continued participation. Grounded in Bandura's (1977) social cognitive theory, the study has also extended the physical activity knowledge base related to self-efficacy and peer and family support systems.

Four hundred sixty-seven adults (mean age: 35.8 years) completed an online survey, the results of which were used to conduct one logistic regression and three ordinary least squares regression models. The logistic regression was employed to determine predictors for compliance to the nationally recommended levels for physical activity (150 weekly minutes of physical activity at moderate levels of intensity or 75 weekly minutes at a vigorous intensity, and two days of muscle strength training). The OLS regression models were conducted to provide deeper insight into the variables making up the national recommendations (moderate intensity, vigorous intensity, and muscle strength training activities).

Self-efficacy was found to be significant in all four models, with gender, peer support, mobile fitness app support, and a participant's significant other's physical activity behaviors also being significant in the national recommendations, vigorous intensity, and muscle strength training models. Age and education were significant in the national recommendations and muscle strength-training models. Race was also significant in the moderate activity and muscle strength training models. Practical implications and suggestions for future research have been provided based on the findings of the study.

CHAPTER 1: INTRODUCTION

Despite the fact that physical activity is essential for physical well-being, the most recent findings from the Centers for Disease Control (CDC, 2013) indicate that less than 25% of the American population participates at sufficient levels for optimal physical well-being. With participating rates so low, it should not be surprising that approximately 68% of adults (Levi, Segal, Rayburn, & Martín, 2015), and 31% of children (Ogden, Carroll, Kit, & Flegal, 2014), are overweight by medical standards. The literature presented in this study will uncover the importance of physical activity in the development and continuation of physical health. Consequently, the absence of physical health will lead to premature death (Cannon, 1932; Maslow, 1943), which indicates that physical health is a basic need for well-being. Although physical activity, in and of itself, may not eliminate the risk of life threatening health conditions, the literature provides evidence to suggest that participation is likely to reduce the risk of such afflictions. The literature will also show that the current health crisis affects a large portion of the United States, which provides evidence to suggest that the entire American population should be considered a vulnerable population where physical health is concerned.

The current study has sought to advance the scientific understanding of emergent technology as a mechanism for physical activity. Specifically, the researcher has investigated whether the social media component built into mobile fitness applications (apps) can be used to predict physical activity. Grounded in social cognitive theory, the study has also extended the knowledge base related to self-efficacy and peer and family support systems. The results provide rationale for the exploration of mobile technology as a support system for other areas of social work, such as community planning and development.

Physical Activity and Social Work

The field of social work is critically invested in upholding social, physical, and emotional wellbeing, and has a rich history of advocacy and community development for vulnerable populations (Boynton, 2015; Tannenbaum & Reisch, 2001). Indeed, social workers are committed to ensuring that all people, regardless of age, race, ethnicity, gender, social class, religion, or sexual orientation, have their basic needs met (National Association of Social Work [NASW], 2008). To accomplish this goal, social workers are oftentimes found in settings such as long-term care facilities, substance abuse programs, and child welfare agencies (Bureau of Labor Statistics, 2015). At first glance though, physical activity promotion may not seem like an obvious “fit” for the field of social work. However, social workers have a long history of using sport and physical activity as an empowerment tool with the people they serve.

The Settlement House Movement was partially founded on the promotion of sport and physical activity. In fact, Jane Addams, a pioneer of modern social work, built one of the first gymnasiums in the United States and incorporated recreational activities into her work with the Hull House residents (Henderson, 1982). In addition to buying land and developing a recreational summer camp for the boys at Hull House, Addams and other settlement house reformers, also advocated for the rights of women and children to have recreational opportunities (Addams, 1912; Boynton, 2015; Chambers, 1986). Indeed, sport and physical activity was used as a community building intervention and was one of the ways early social workers engaged the immigrant population, especially young boys (Addams, 1912). Yet, modern social work has largely not sustained the historical importance to offer, investigate, and apply physical activity into practice (M. Moore, personal communication, October 16, 2015). For example, Gill (2014) discussed the dearth of social work research with college athletes, which is an irony as many

athletes coming from disenfranchised backgrounds could benefit from the intervention of social work principles and practice. However, a small, but growing number of social workers do specialize in sport and physical activity. The inaugural Social Work in Sports conference was held in October of 2015, at which time social workers presented research findings in a number of areas, including youth, high school, college, and professional sports/physical activity settings.

Despite the fact that a small cohort of social workers specialize in sport and physical activity, Williams and Streat (2006) have urged the entire field to become educated in the health benefits of physical activity and to integrate physical activity promotion into social work practice. To that end, the findings of the current study have been partially tailored to the field of social work, specifically in the areas of program development and practice. The results will provide social workers with practical methods for integrating physical activity into daily practice to assist in ameliorating adverse life conditions.

Statement of the Problem: A Health Crisis

A health crisis exists in the United States. Cancer and heart disease remain two of the most prominent causes of death (National Center for Health Statistics [NCHS], 2015), 68% of adults are considered overweight (Levi et al., 2015), and approximately 30% of adults are clinically obese (Ward, Schiller, & Freeman, 2014). Additionally, an estimated 30% of American adults live with hypertension (NCHS, 2015), and 55% of those living with hypertension also receive treatment for uncontrolled blood pressure.

National rates are revealing. However, local health figures are alarming for some states, such as Louisiana. Compared to a national average of 30%, Louisiana's 34.9% obesity rate makes the bayou state the fourth most obese state in the country (Levi et al., 2015). Similarly, Louisiana residents have the 4th highest occurrence of hypertension and the 12th highest diabetes

rate. Equally distressing is while many states have seen an improvement in this area, Louisiana has gotten worse. In 2006, 13 states had higher prevalence rates of heart disease than Louisiana (CDC, 2011). From 2006 to 2010, all 13 of the aforementioned states saw reductions anywhere from 2% to 25%. However, Louisiana's prevalence rate increased more than 8% (CDC, 2011). Findings have also indicated that both men and women in Louisiana rank in the top 10% nationally for having the highest risk of being diagnosed with heart disease (Yang et al., 2015). Incidentally, men in Louisiana have the highest risk among all states. Men in Louisiana also rank second in the country for all incidences of cancer and fourth in the country for cancer-related deaths (U.S. Cancer Statistics Working Group, 2015).

The literature presented in the following chapter will highlight the known benefits of physical activity, which will include evidence to suggest that regular physical activity can reduce the risk of cancer, heart disease, obesity, and hypertension. However, despite the known benefits, roughly 60% of the country is inactive or does not participate at recommended levels for producing health benefits (CDC, 2014). Consistent with local health statistics, residents in Louisiana are the third most inactive in the United States (Levi et al., 2015).

Child obesity rates in Louisiana are also among the highest in the country (Levi et al., 2015), and reports have indicated that youth activity rates are among the lowest in the country (CDC, 2014). The ([PBRC], PBRC, 2012) revealed that less than 20% of Louisiana parents were familiar with the recommended levels of physical activity, which should not be surprising given the current health of adults in the state. Incidentally, this finding is important because research has long suggested that active youth are more likely than inactive youth to become active adults (Perkins, Jacobs, Barber, & Eccles, 2004). Findings have also indicated that youth are more likely to participate in physical activity if they see their parents participating as well (Beets &

Foley, 2008; Ornelas, Perreira, & Ayala, 2007). Thus, current trends, combined with existing literature, support previous findings that suggest inactive and obese youth will become inactive and obese adults (Pietilainen et al., 2008; Serdula et al., 1993).

Rationale for Study

The current study has sought to expand the scientific understanding of physical activity motivation through the use of smartphone mobile technology. The Pew Research Center has recently projected that 90% of American adults have a cell phone, and 64% of American adults take advantage of smartphone mobile technology (M. Anderson, 2015). As early as 2007, research findings suggested that mobile phones could be used for personal fitness (I. Anderson et al., 2007). In 2012, Fox and Duggan (2012) estimated that 52% of Americans used their smartphone for health related purposes and that 19% had one or more health related app. Research2guidance (2015) speculates that more than 50% of smartphone users will have at least one health related app by 2017.

With the emergent popularity of social media, software developers have begun incorporating components of social media into mobile fitness apps. These components allow users to easily engage with peer support networks. No known research has explored the social motivation provided by mobile fitness apps. Thus, using Bandura's (1977) social cognitive theory as a framework, the current study explored the social media component of mobile fitness apps as a predictor of physical activity behavior.

CHAPTER 2: LITERATURE REVIEW

The first section of this chapter defines physical activity and present literature pertaining to the benefits and barriers of physical activity. Social cognitive theory is then offered as a mechanism for examining physical activity behavior. Each of the constructs are presented with special attention given to the constructs of self-efficacy and social support systems. The final section describes the conceptual framework of the study and discusses the variables included in the analysis.

Physical Activity

Physical activity refers to any physical undertaking focused on exercise and physical fitness (United States Department of Health and Human Services [HHS], 2008). Physical activity is often discussed in terms of moderate- and vigorous-intensity activities. Fast bicycling and singles tennis are each examples of vigorous-intensity activities, and a leisurely bicycle ride or doubles tennis would all likely be considered moderate-intensity activities (Craig et al., 2003). During a moderate-intensity activity, two people would be able to carry on a conversation; however, two people engaged in a high-intensity activity would likely not be able to say more than a few words at a time before getting winded (Loose et al., 2012; Persinger, Foster, Gibson, Fater, & Porcari, 2004).

Benefits

Physical activity is commonly associated with benefits such as increased muscle strength, increased endurance, and weight control; however, studies have shown there are numerous benefits to participating in physical activity (Feltz, Short, & Sullivan, 2008; Janssen & LeBlanc, 2010; Tomporowski, Davis, Miller, & Naglieri, 2008). Accordingly, national recommendations

for physical activity are a result of the literature surrounding the numerous potential benefits (HHS, 2008), and many of the benefits can be associated with physical and mental health.

Physical health. Physical activity is important for the development of motor control and the maintenance of healthy bones (Šalaj, Krmpotić, & Stamenković, 2014; J. Smith et al., 2014). Regular bouts of physical activity may also help sustain healthy blood pressure levels and reduce the risk of certain fatal diseases, such as cancer and heart disease (Altena, 2014; Shen et al., 2014; Sugawara et al., 2012). Research also suggests that physical activity plays an important role in the functioning of many hormones in the body. For example, physical activity can increase levels of leptin, a hormone responsible for hunger (Tiryaki-Sonmez et al., 2013). Increases in leptin will allow the body to better regulate the need for food. Exercise also promotes the production of cortisol, a hormone associated with the immune system, and protects the body against allergies (Foss, Sæterdal, Nordgård, & Dyrstad, 2014).

In addition to reducing the risk of disease, physical activity can also help those people who are already living with life-altering diseases. For example, physical activity has been shown to be an important determinant of health in people with multiple sclerosis (Giacobbi, Dietrich, Larson, & White, 2012). Although physical activity will not stop the disease or slow down the degradation process, regular exercise can help these patients feel better and cope with the situation of their disease (Learmonth, Paul, Miller, Mattison, & McFadyen, 2012). Specific benefits include improving strength, maintaining weight, and lessening signs of fatigue (Tarakci, Yeldan, Huseyinsinoglu, Zenginler, & Eraksoy, 2013).

Mental health. In addition to physical health benefits, many studies have provided evidence to support the belief that mental health can be improved by physical activity (Baxter, Scott, Vos, & Whiteford, 2013; Dienstbier, 1989; Feltz et al., 2008; Hartwig, Naughton, & Searl,

2009; Salmon, 2001; Ströhle, 2009). For instance, the physiological toughness model has proposed the use of previous experiences to assess a person's propensity to adapt to stressful situations (Dienstbier, 1989). By using physical activity to gain tolerance to certain levels of stress, individuals are likely to see improvements in performance, self-efficacy, and mental processes (Feltz et al., 2008; Salmon, 2001). Moderate to rigorous levels of physical activity may also help the body recover faster from stressful situations (Hartwig et al., 2009).

In addition to helping the body recover from stressful situations, physical activity may also be beneficial to lowering anxiety levels. Although not every person diagnosed with an anxiety disorder is inactive, recent studies have proposed a link between physical activity and reduced anxiety. Yiğiter, Gürer, and Tiryaki (2013) examined 141 inactive high school students and found that more than half exhibited trait anxiety, a dispositional form of anxiety. Similarly, Brunes, Augestad, and Gudmundsdottir (2013) reported that inactive people have higher levels of anxiety than those participating in physical activity on a consistent basis. As rates of mental health diagnoses increase, researchers have begun exploring the use of physical activity, specifically aerobic exercise, to alleviate the emotional discomfort associated with such afflictions (Baxter et al., 2013; Ströhle, 2009). Despite the known health benefits of physical activity, many people remain inactive. For this reason, researchers have explored the various factors that contribute to inactivity.

Barriers

Extensive research has been conducted to explore the determinants of participating in physical activity, the findings of which have revealed that there are a number of barriers to physical activity (see Chillón et al., 2014; Datar, Nicosia, & Shier, 2013; Demissie, Lowry, Eaton, Hertz, & Lee, 2014; Dishman & Sallis, 1994; Sallis et al., 2013). Dishman and Sallis

(1994) proposed that environmental factors may act as individual barriers to physical activity participation. For example, Chillón and associates (2014) suggested the physical environment, namely weather, may be a barrier for participation in physical activity. Safety can be an additional barrier, as Sallis and associates (2013) found increases in participation for activities such as bicycling were more likely if local traffic conditions were improved. Similarly, (Datar and Colleagues Datar et al.) provided evidence to suggest parental perceptions of neighborhood safety issues, such as crime and violent behavior, were negatively associated with youth physical activity. Likewise, prevalence of aggressive behaviors on school grounds has also been associated with physical inactivity (Demissie et al., 2014). In fact, a number of recent studies have supported the hypothesis that perceptions of crime and neighborhood gang activity are significant deterrents of physical activity for both youth and adults (Chillón et al., 2014; Cleland et al., 2015; Duke, Borowsky, & Pettingell, 2012; Stodolska, Shinew, Acevedo, & Roman, 2013; Weiss, 2011).

The perceived motivational climate represents another possible barrier to physical activity participation (Domangue & Solmon, 2010; Duda, 2005; Gilson, Chow, & Ewing, 2008; Nicholls, 1984; Solmon, 1996). Motivational climates may be conceptualized as either task-oriented or ego-oriented. A training environment focused on learning and mastering a skill is referred to as a task climate, whereas an ego climate is focused on winning and normative outcomes (Ames, 1992; Balaguer, Duda, & Crespo, 1999). An example of an ego-oriented climate could be a personal trainer berating someone for not losing as much weight as another person in the gym. Thus, ego climates are often associated with fostering low perceptions of ability, and individuals involved in such environments tend to show low levels of persistence in the face of adversity (Duda, 2005; Nicholls, 1984; Solmon, 1996). As a consequence, previous

findings indicate that perceived ego climates foster increased levels of participant burnout (Chiung-Huang et al., 2011). Furthermore, Domangue and Solmon (2010) provided evidence to suggest that ego-oriented climates may deter students with low levels of competence from continuing physical activity participation.

On a micro level, personal barriers may also affect physical activity levels, such as employment status (Finkelstein, Brown, Brown, & Buchner, 2008; Shaw & Spokane, 2008), perceptions of ability (Saligheh, McNamara, & Rooney, 2012; Shimada, Lord, Yoshida, Kim, & Suzuki, 2007), and self-efficacy levels (Brassington, Atienza, Perczek, DiLorenzo, & King, 2002; Cheung et al., 2006; Stiggelbout, Hopman-Rock, Tak, Lechner, & Mechelen, 2005). Due to controllability, personal barriers to physical activity participation are often the focus of interventions (Dishman & Sallis, 1994). Put differently, helping a single mother adjust her schedule and find time to work out is perceived as more manageable than changing neighborhood gang activity. Likewise, an intervention based on increasing general fitness knowledge is a practical and easy way to remove a personal barrier (Rimmer, Hsieh, Graham, Gerber, & Gray-Stanley, 2010). Hence, education is a major reality in terms of countering the ill effects of low activity.

Measurement

Depending on the parameters of a study, researchers may opt to examine physical activity in relation to duration, frequency, and/or intensity (Dishman, Washburn, & Schoeller, 2001), all of which affect the influence physical activity has on the body (Babraj et al., 2009; Børsheim & Bahr, 2003; Campbell et al., 2012; Lee, Park, Kim, Choi, & Kim, 2012). Duration is defined as the length of time a person engages in a specific exercise, and frequency is how often a person

exercises (Plowman & Smith, 2011). Intensity refers to the amount of effort a person puts forth in relation to his/her maximum effort ability.

Two ways to examine physical activity are through objective and subjective measures. Subjective measures allow researchers to obtain a sense of the participant's perception of a phenomenon (Wills & Shinar, 2000). One example of a subjective measure is a physical activity journal (Dishman et al., 2001; Sirard & Pate, 2001), where researchers may ask participants to keep a log of their physical activity experiences, including frequency, duration, and intensity. Another method of subjective measurement is a self-report survey, such as Pate and associates' (2003) 3 Day Physical Activity Recall, in which participants account for their physical activity behavior in 30 minute time blocks for a period of three days.

respond to specific questions about physical activity based on the needs of a study.

Pedometers and accelerometers are two forms of objective physical activity measures. Pedometers measure physical activity by counting the steps a participant takes, and accelerometers measure physical activity by determining accelerations that can be converted into activity counts (Cardon & De Bourdeaudhuij, 2007). While objective measures excel in providing an indication of exact duration, they tend to be more expensive than subjective measures, and many lack the ability to provide an indication of personal perception or intensity (Visser, Krosnick, & Lavrakas, 2000).

Both forms of measurement have strengths and weaknesses; thus, researchers should consider the budget for a study as they choose the best measures to answer the research questions. For example, given that pedometers lack the ability to gauge intensity (Dishman et al., 2001), they are not likely the best measurement option for studies examining adherence to the national physical activity recommendations in the United States.

National Recommendations

Researchers from the U.S. Government Accountability Office (Bascetta et al., 2005) conducted a survey of medical professionals and found that doctors felt as though physical activity was the number one way to combat obesity. Although physical activity may not eliminate the risk of obesity and other life-altering health conditions, current findings indicate participation in physical activity is likely to reduce the risk of such afflictions (Altena, 2014; Shen et al., 2014; Sugawara et al., 2012). These findings are among the reasons why physical activity recommendations have been developed for all Americans (HHS, 2008). Specifically, adults are recommended to participate in at least 150 weekly minutes of aerobic physical activity at a moderate intensity or 75 minutes of vigorous physical activity. In addition, adults are also advised to participate in at least two days a week of full-body strength training. For optimal health, the suggested aerobic activity levels increase to 300 minutes at a moderate level of intensity or 150 minutes at vigorous intensity levels (HHS, 2008).

Overall physical activity rates were declining prior to the implementation of national recommendations (see Brownson, Boehmer, & Luke, 2005). Despite the current recommendations, recent statistics suggest youth and adult populations in the United States are still participating at levels below those that have been recommended by HHS (see CDC, 2013; 2014; PBRC, 2009; 2012). For instance, the CDC (2014) has estimated less than 30% of high school students engage in 60 minutes of daily physical activity. Based on national reports, it is not surprising that in some places, like Louisiana, youth are not expected to reach targets established in the Healthy People 2020 initiative (Office of Disease Prevention and Health Promotion, 2010), despite small increases in participation (PBRC, 2009; 2012). Similar rates have also been found for college age young adults (Keating, Guan, Piñero, & Bridges, 2005;

NCHS, 2010). Adult rates are only marginally higher than youth, with just more than 40% of adults estimated to be participating at the minimum physical activity levels (CDC, 2014). Furthermore, national reports have suggested only 20.5% of adults participate at the recommended levels for optimal health (CDC, 2013).

Theoretical Framework: Social Cognitive Theory

Albert Bandura's Bobo doll experiment provided evidence to suggest that behavior can be learned from others (Bandura, Ross, & Ross, 1961). The Bobo doll, an inflatable clown-like punching bag, was used as a prop in a randomized controlled experiment. The experiment consisted of exposing young children to situations where they witnessed adults either being aggressive, or not being aggressive, to the Bobo doll. The experiment showed that, when left alone, children were more likely to exhibit aggressive behaviors when they observed adults exhibiting aggressive behaviors (Bandura et al., 1961). The experiment was successfully expanded upon in 1963, when comparable results were seen from children who observed aggressive behavior via film (Bandura, Ross, & Ross, 1963).

During a time when many behaviorists rejected the notion that behavior could be predicted by something unobservable, such as socialized learning (Bandura, 1999), Bandura's (1977) social learning theory changed behavior research by presenting the concepts of self-efficacy and observational learning. Social learning theory was later renamed social cognitive theory when Bandura (1986) expanded his theory to explain behavior through a multidirectional influence of a person, a person's environment, and a person's behavior.

Social cognitive theory is grounded in triadic reciprocal determinism, a model postulated to account for the multidirectional influence of personal factors, environmental factors, and behavioral factors to determine human agency (Bandura, 1986). Put differently, the model

suggests personal and environmental factors affect a person's behaviors in the same way behavior affects personal and environmental factors (Bandura, 1989). For example, a teenager may not be able to participate in a sporting event unless the parents agree to provide transportation. In the same way, the parent may not agree to provide transportation unless the teenager does all required chores. Furthermore, the direction and intensity of the influence between the aforementioned factors are believed to be constantly changing and dependent upon a person's perception of the world at any given moment, which is believed to be constructed via a process called human agency (Bandura, 1986).

In the social sciences, agency is the capacity of individuals to act independently and to make their own choices freely. Human agency is hypothesized to be reflective of four distinct elements: intention, forethought, self-reactiveness, and self-reflectiveness (Bandura, 2006b). Bandura (1986) posited that human beings are able to gain knowledge about their surroundings and to cultivate meaning and value based on that knowledge. Moreover, people make situational and dispositional preferences based on the meaning and value derived through lived or vicarious experiences. Thus, intentions are developed from the meaning and value people obtain from lived or vicarious experiences (Bandura, 1989). Based on intent, proximal and distal goals may be established to motivate and guide, whereas self-reactiveness refers to the process of goal realization (Bandura, 2001). People then reflect on their actions and make adjustments for future behavior (Bandura, 1989).

Personal Factors

Self-efficacy. Self-efficacy and outcome expectations are examples of personal factors proposed to influence human agency. According to Bandura, self-efficacy pertains to a person's perception of his/her ability to be successful at a given task (Bandura, 1989). Research findings

have consistently suggested self-efficacy is the strongest predictor of physical activity behavior within social cognitive theory, especially in studies with follow-up examinations (see Bean, Miller, Mazzeo, & Fries, 2012; Dewar et al., 2013). This significant finding is consistent across varying socioeconomic statuses and ages: preadolescents (Bean et al., 2012), adolescents (Dewar et al., 2013), young adults (Tavares, Plotnikoff, & Loucaides, 2009), middle aged adults (Rogers, McAuley, Courneya, Humphries, & Gutin, 2007), and older adults (White, Wójcicki, & McAuley, 2012).

Recent studies have also upheld the theorized triadic reciprocal model by indicating that many of the other social cognitive theory constructs were associated with self-efficacy, such as social support and barriers (see Ramirez, Kulinna, & Cothran, 2012). Self-efficacy is theorized as being influenced by four constructs: verbal persuasion, vicarious experiences, physiological states, and past performances (Bandura, 1977).

Verbal persuasion. Bandura (1977) suggested that verbal persuasion influences self-efficacy. Verbal persuasion can stem from internal sources, such as self-talk, or external sources, such as feedback from parents, friends, and coaches. Therefore, coaches must be committed to providing appropriate feedback based on a player's skill level (Senécal, Loughhead, & Bloom, 2008). Appropriate constructive feedback does not entail being praised when a participant knows a performance was unsatisfactory, nor does it consist of being yelled at or made to feel as though success is not attainable while never providing a clear understanding of errors (Gilson & Feltz, 2012). Thus, the type and appropriateness of feedback largely determine the directional nature of the influence of verbal persuasion as it relates to skill level and performance (Bandura, 1977; Senécal et al., 2008).

Vicarious experiences. Early psychological theories only considered learning by actual experience; however, social cognitive theory posits that people are able to gain knowledge vicariously (Bandura, 1999). Vicarious learning allows a person to gain knowledge without actually participating in a particular activity. Likewise, learning through observation provides individuals with a means of gauging personal value (Bandura, 1977). In addition, vicarious learning provides specific details regarding aspects of a task that are pertinent in deciding if the activity will be adopted. For example, training for a marathon requires a certain amount of time, running shoes, and a well-devised plan to get a person's body in the shape needed to be able to complete the marathon. A potential marathon runner can then process these requirements to decide if the requirements are personally worth the outcome (Bandura, 1999).

Physiological/affective states. The body's physiological state may affect a person's efficacy for a specific task (Bandura, 1997). For example, if a marathon runner has been feverish and light headed for three days prior to a race, the perception may change of his or her ability to be successful in the upcoming race (Feltz et al., 2008). In a similar way, research has provided evidence to support the hypothesis that emotional or affective states also influence levels of self-efficacy (Hauck, Carpenter, & Frank, 2008).

Past performances. Bandura (1977) postulated that previous successes and/or failures in any given task affect self-efficacy and subsequently affect behavior. According to Bandura, positive experiences tend to foster self-efficacy and are more likely to increase intent for future participation. Conversely, negative experiences tend to discourage increases in self-efficacy and deter intent for future participation (Bandura, 1977). Moreover, successful past performances do not always involve winning as an outcome; successful mastery of a task may also result in a

positive experience (Usher & Pajares, 2008; Valiante & Morris, 2013). Hence, Bandura (1988) has advocated for the use of efficacy expectations rather than outcome expectations.

Outcome expectations. Another personal factor hypothesized to influence physical activity behavior is outcome expectations, which refers to an individual's perception of the end product (Bandura, 1989). Consistent with the triadic reciprocal model, Bandura (1999) hypothesized each of the constructs within social cognitive theory influence outcome expectations, just as outcome expectations influence the other constructs. As expected, activities tend to be pursued if an individual perceives success is possible; likewise, activities are more likely to be avoided if failure is the perceived outcome (Bandura, 1989). Computerized technology has the ability to provide detailed simulations at the touch of a screen; for this reason Bandura (1999) suggested that positive and negative outcomes are more readily tested than ever before. For example, a runner can generate tables and graphs to provide monetary estimates, time requirements, and projected physical interventions needed to complete a marathon.

Environmental Factors

Whether referring to self-selected environments or those environments out of a person's control, Bandura (1997) theorized environments, such as social support systems, shape behaviors just as behaviors shape environments. Recent findings have indicated social support systems and levels of self-efficacy may be the greatest predictors of physical activity behaviors (Bean et al., 2012; Gao, 2012; Harmon et al., 2014; Martin & McCaughtry, 2008; Martin, McCaughtry, Flory, Murphy, & Wisdom, 2011). Social support can take on many forms: *instrumental*, or tangible support such as providing transportation; *emotional*, such as praise and encouragement; *informational*, such as instruction or suggestions; *companionship*, such as collaboration or taking part in an activity; and *validation*, such as comparison to social norms (Wills & Shinar, 2000). In

sport and physical activity research, social support systems tend to include coaches, trainers, parents, and peer support; depending on the environment, the support systems may utilize a multitude of support types (Beets, Vogel, Forlaw, Pitetti, & Cardinal, 2006; Duncan, Duncan, & Strycker, 2005; Robbins & Rosenfeld, 2001; Scanlan, Carpenter, Lobel, & Simons, 1993; Sheridan, Coffee, & Lavalley, 2014).

Coach/trainer support. Previous research has consistently supported the postulation that coaches and trainers have the ability to affect both physical activity behavior and levels of self-efficacy (Gilson & Feltz, 2012). In fact, the majority of social support research in the field of sport and exercise science has been in the area of coach support (Duda, 2005; Sheridan et al., 2014). Findings have suggested that how support from a coach is perceived may be influential to levels of performance, self-efficacy, and persistence (Gilson & Feltz, 2012; Jöesaar, Hein, & Hagger, 2012). Significant factors include the coach-created motivational climate, the perception of the coach's assessment of the athlete's competence, and the amount and type of feedback provided by the coach (Jackson, 2010; Santi, Bruton, Pietrantonio, & Mellalieu, 2014). Collaborative goal setting has also been associated with physical activity behavior and self-efficacy (Gilson & Feltz, 2012).

Family support. Family support has been shown to be a predictor of self-efficacy and physical activity behavior throughout the lifespan. For example, as infants learn to walk they look to their parents for confirmation of success and to obtain a sense that their parents are pleased with their mastery of a task (Harter, 1978). Thus, behaviors are likely to persist the more children feel as though their parents perceive success is attainable (Ornelas et al., 2007). As children grow into adolescents, many rely on family members to provide unique tangible sources of support, such as participant entrance fees, equipment, and transportation (Beets, Cardinal, &

Alderman, 2010). However, for some elite athletes, peer interaction may be regulated so much that peer support is not influential, leaving athletes to continue relying on parents for emotional support (Hayman, Borkoles, Taylor, Hemmings, & Polman, 2014).

In adulthood, familial support is often provided by spouses by way of emotional and companionship support (Ayotte, Margrett, & Patrick, 2013). For example, Berge, MacLehose, Eisenberg, Laska, and Neumark-Sztainer (2012) found that both men and women are more likely (15.5% and 14.3%, respectively) to participate in physical activity if they participate with a spouse or partner. Furthermore, research has suggested that companionship during activity may be one of the most influential determinants of adult sport and physical activity participation (Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2007). Moreover, physically active couples tend to give and receive more support with their spouses than couples not engaged in similar amounts of physical activity (Hong et al., 2005). However, even if spouses are not willing or able to participate, emotional support and verbal encouragement has been shown to influence sport and physical activity adherence (Kouvonen et al., 2012).

Peer support. The final type of social support system discussed is peer support. Peer support refers to classmates, teammates, close friends, or co-workers and has the capability to be a very powerful predictor of self-efficacy and physical activity behavior (Gao, 2012; Harmon et al., 2014; Martin & McCaughtry, 2008; Martin et al., 2011). Many recent studies have suggested that peer social support and self-efficacy are among the strongest predictors of adolescent physical activity behavior (Harmon et al., 2014; Martin et al., 2011). In fact, a small body of literature exists supporting peer social support as a more significant predictor over self-efficacy (Gao, 2012; Martin & McCaughtry, 2008).

Research in many fields of study has long suggested social support from peers can influence behavior (Anderssen & Wold, 1992; Gao, 2012; Harmon et al., 2014; Kirby, Levin, & Inchley, 2011; Martin & McCaughy, 2008; Martin et al., 2011). For example, in substance abuse treatment (Kaplan, Nugent, Clark, & Veysey, 2010), peer support may come in the form of self-help groups, peer advocates, or paraprofessional counselors employed by treatment facilities. These forms of support have been hypothesized as being influential because the supporters have knowledge of what the clients are going through because they have been through the process themselves (Conner, Rosen, Wexle, & Brown, 2010; Kaplan et al., 2010; Miller, Ninonuevo, Hoffmann, & Astrachan, 1999). Thus, clients in these treatment facilities feel comforted in thinking they will receive better treatment from someone who has intimate personal experiences with addiction.

Peer support for physical activity may be influenced in the same way. People may be swayed to participate, or even to persevere in the face of adversity, if encouraged by like-minded individuals (Chang, Brown, & Nitzke, 2009). For example, in a recent qualitative study, Burke, West, Grocott, Brunet, and Jack (2015) revealed cancer patients were motivated by their peers to continue physical activities at times when they otherwise would not have continued. Findings have also indicated that having friends who value and want to participate in physical activity will often lead to increased individual levels of physical activity (Davison, 2004; Maturo & Cunningham, 2013; Saxena, Borzekowski, & Rickert, 2002). Corder and colleagues' (2013) longitudinal study revealed that youth physical activity might be most influenced by their peers on school days. In fact, Edwardson and colleagues (2013) found that peer support was the most influential factor in determining after-school physical activity levels. Accordingly, the frequency

and duration of contact with peers have also been found to be significant predictors of physical activity (Kirby et al., 2011).

Similar findings have been found in sport-specific literature. Research has consistently provided evidence to suggest that the motivational climate maintained by peers is linked to sport enjoyment, satisfaction, commitment, and participation (Santi et al., 2014; Torregrosa et al., 2011; W. M. Weiss & Weiss, 2003). Therefore, high levels of perceived teammate support may also act as a protective factor against risk factors such as low self-confidence, low self-efficacy, and burnout (DeFreese & Smith, 2013; Freeman & Rees, 2010; Marcos, Miguel, Oliva, & Calvo, 2010). Similar to the influence of coaches and parents, teammate support also plays a vital role in the development of goal orientations; for example, athletes are more likely to focus on skill development, rather than outcomes, if they do not receive criticism by peers for lackluster performances (Atkins, Johnson, Force, & Petrie, 2015). Additionally, although some elite athletes may be socially restricted (Hayman et al., 2014), others have reported that peer support was influential throughout their professional career (Keegan, Spray, Harwood, & Lavalley, 2014).

In addition to common interests, findings have suggested demographic information may also moderate the effect social support systems have on physical activity behavior (Edwardson et al., 2013). Existing literature has supported the hypothesis that age is a moderating factor in the relative impact of social support systems (Bean et al., 2012; Edwardson et al., 2013). Whereas younger children are more likely to be influenced by their parents, adolescents tend to gravitate towards their peers. Research findings have also suggested that peer support may be moderated by gender; specifically, that young males may perceive more support for physical activity than females (Edwardson et al., 2013; Kirby et al., 2011). However, van Dam and associates (2005)

presented evidence to suggest diabetic men may be negatively influenced by spousal support, whereas women are likely to be positively influenced by their spouses. The discrepancies in these studies suggest that age or illness, may also moderate the effects gender has on social support.

With the advancement of technology has come new methods for social support; thus, understanding peer support by technological means is a new endeavor for researchers. For this reason, a small, but growing body of literature exists which seeks to discover the mechanisms by which physical activity is moderated by new technology.

Peer support and smartphone technology. Cell phone technology has developed rapidly over the past two decades, with people now being able to check email, send text messages, manage bank accounts, and download apps for almost any purpose. A result of this ever-changing technology is people have become dependent on their cell phones for activities of daily living (Gibbs, 2012).

Cell phones have recently become a medium for physical activity, with apps available for people of varying fitness levels and interests (Middelweerd, Mollee, van der Wal, Brug, & te Velde, 2014). Some apps serve as a method to keep track of caloric intake (for example, "myfitnesspal"; MyFitnessPal LLC, 2015), while others, like "Garmin Connect" (Garmin Ltd, 2015) allow users to upload and view data from dedicated wearable activity tracking fitness devices. Some apps even provide detailed workout routine options for users (see Jefit Inc., 2015) or provide prompts reminding users to be active after a certain amount of sedentary time (see Dantzig, Geleijnse, & Halteren, 2013). In fact, many of the apps integrate with one another to permit the user a full experience while taking advantage of the unique characteristics of each

app. For example, activity data from Garmin Connect can integrate with myfitnesspal to allow the user to apply physical activities to their overall health profile.

A growing body of literature is forming where the use of mobile technology is being examined in relation to physical activity behavior. Results have been promising, with a number of studies concluding that mobile fitness apps provide awareness of individual dietary and physical activity behaviors (I. Anderson et al., 2007; Dantzig et al., 2013; Mattila et al., 2008; Nguyen, Gill, Wolpin, Steele, & Benditt, 2009). Further, results have suggested interventions including mobile fitness apps have yielded increases in physical activity as well as positive changes in other health indicators, such as weight and heart rate (Fukuoka, Vittinghoff, Jong, & Haskell, 2010; Stuckey et al., 2011).

Many of the available apps also include a social media component. For example, Garmin Connect, Jeffit, and myfitnesspal each permit users to allow friends to view their daily progress. In addition, forums are available for users to receive peer support for diet and fitness routines. While many apps provide visual feedback or prompts for a user to be more active (see Mattila et al., 2008; Nguyen et al., 2009), peer driven social support has been underrepresented in recent studies. Interventions have incorporated peer social support (see Toscos, Faber, Connelly, & Upoma, 2008); however, peer driven support was received via text message instead of within the app. Furthermore, no known studies have used social cognitive theory as a framework for exploring the built-in social media aspects of fitness apps. Therefore, the current study sought to build on previous literature and advance the scientific understanding of social support systems via mobile devices.

Demographic Characteristics

Extant literature has provided insight into how demographic variables, such as race, gender, and socio economic status, may moderate the effects of constructs found within social cognitive theory (Dishman et al., 2002; Edwardson, Gorely, Musson, Duncombe, & Sandford, 2014; Kirby et al., 2011). For example, non-Hispanic Whites may be more influenced by the constructs within social cognitive theory than Hispanic (Gao, 2012; Harmon et al., 2014) or Black (Dishman et al., 2002; Dishman, Saunders, Motl, Dowda, & Pate, 2009; Trost et al., 1997) participants. However, the findings in Rogers and associates' (2007) study concluded Black participants were more influenced by social cognitive constructs than Whites; thus, additional research is necessary to further assess the moderation of race within the theory (Dishman et al., 2009; Rogers et al., 2007).

Gender may also moderate the effect social cognitive constructs have on physical activity. Specifically, research has consistently concluded that males are more likely to participate in physical activities (Dzewaltowski, Ryan, & Rosenkranz, 2008; Kirby et al., 2011; Martin et al., 2011; Patnode et al., 2010; Raudsepp, 2006; Woods, Graber, & Daum, 2012) and more likely to exert a greater amount of energy than females (Martin et al., 2011). Similarly, males may be more influenced by peer support systems (Edwardson et al., 2014; Edwardson et al., 2013; Kirby et al., 2011; Martin et al., 2011; Patnode et al., 2010) and receive more paternal support and modeling (Edwardson et al., 2014; Kirby et al., 2011; Raudsepp, 2006) than females. Findings have also provided evidence to suggest that males have greater levels of self-efficacy (Beets et al., 2006; Martin et al., 2011; Trost et al., 1997) towards physical activity than their female counterparts. In contrast, young females may perceive more maternal support than young

males (Edwardson et al., 2014) and may have better adherence in smaller groups (Woods et al., 2012).

Socioeconomic status has also been found to be a significant predictor of social cognitive constructs, specifically tangible support. Indeed, both Edwardson and colleagues (2014) and Raudsepp (2006) determined that household income was directly related to the tangible support parents were able to provide. Put differently, if parents are struggling financially, they are less likely to spend surplus cash on non-essential tangible support, such as gas for transportation, entrance fees, or equipment (Eime, Harvey, Craike, Symons, & Payne, 2013).

Current Limitations

Variable inclusion. Self-efficacy is one of the strongest predictors of physical activity (Bean et al., 2012; Dewar et al., 2013), and the self-efficacy construct has emerged as a prominent stand-alone theory within the social cognitive approach. For this reason, the self-efficacy construct has been utilized more often than any of the other constructs within the theory (Rhodes & Nigg, 2011). However, current reviews have advocated for the inclusion of the full social cognitive theory framework when examining physical activity behavior (Rhodes & Nigg, 2011; Young, Plotnikoff, Collins, Callister, & Morgan, 2014). This recommendation is based on the need to fully test the effect of social cognitive theory on physical activity behavior. In fact, Young and colleagues' (2014) recent meta-analysis of 55 studies indicated that only 40% of the studies utilized the complete social cognitive theory framework.

Theory integration. Rhodes and Nigg (2011) proposed that future researchers modify social cognitive theory to fit the specific needs of a population. Likewise, existing literature has also proposed that future studies combine social cognitive theory with other well-established frameworks, such as Bronfenbrenner's (1979) ecological theory, to obtain a more clear

understanding of physical activity behavior (Dewar et al., 2013; Martin et al., 2011; Plotnikoff, Lubans, Penfold, & Courneya, 2014; Ramirez et al., 2012). A systematic review conducted by Rhodes and Nasuti (2011) discussed how ecological factors are increasingly being incorporated into physical activity research. For instance, Zhang, Solmon, Gao, and Kosma (2012) recently found evidence to support the integration of ecological and social cognitive theory constructs. Consistent with social cognitive theory, self-efficacy and social systems were revealed as integral factors explaining physical activity behavior. With regard to ecological systems, the authors advocated for the formation of groups that intertwine school and family systems to better promote physical activity (Zhang et al., 2012). Nevertheless, Rhodes and Nasuti (2011) noted that most of the studies incorporating ecological factors were correlational studies, and that making any real change would be difficult. Given that the field of social work has a long history with community organizing and advocacy (Addams, 1912; Chambers, 1986; Reid & Edwards, 2006), developing programs and designing initiatives to make environmental changes may be one the most beneficial ways for the social work profession to reenter the field of physical activity promotion.

Conceptual Framework

The primary purpose of this study was to examine mobile fitness support as a predictor of physical activity at the nationally recommended levels. Secondly, the study sought to test constructs within Bandura's social cognitive theory as predictors of physical activity at the nationally recommended levels. The correlational study was cross-sectional in nature and utilized primary data to examine the research questions. Based on existing literature, the following research questions and hypotheses guided the current study:

Primary Research Question: Research Question One

Do social cognitive theory constructs predict adult physical activity at the nationally recommended levels for substantive health benefits?

- H₀₁ Social cognitive theory constructs will not predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₁ Social cognitive theory constructs will predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₀₂ Peer support will not predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₂ Peer support will predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₀₃ Familial support will not predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₃ Familial support will predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₀₄ Self-efficacy will not predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₄ Self-efficacy will predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₀₅ Mobile fitness app support will not predict adult physical activity at the nationally recommended levels for substantive health benefits.
- H₅ Mobile fitness app support will predict adult physical activity at the nationally recommended levels for substantive health benefits.

Supporting Research Question: Research Question Two

Do social cognitive theory constructs increase adult physical activity at moderate levels of intensity?

- H₀₆ Social cognitive theory constructs will not increase adult physical activity at moderate levels of intensity.
- H₆ Social cognitive theory constructs will increase adult physical activity at moderate levels of intensity.

- H₀₇ Peer support will not increase adult physical activity at moderate levels of intensity.
- H₇ Peer support will increase adult physical activity at moderate levels of intensity.
- H₀₈ Familial support will not increase adult physical activity at moderate levels of intensity.
- H₈ Familial support will increase adult physical activity at moderate levels of intensity.
- H₀₉ Self-efficacy will not increase adult physical activity at moderate levels of intensity.
- H₉ Self-efficacy will increase adult physical activity at moderate levels of intensity.
- H₀₁₀ Mobile fitness app support will not increase adult physical activity at moderate levels of intensity.
- H₁₀ Mobile fitness app support will increase adult physical activity at moderate levels of intensity.

Supporting Research Question: Research Question Three

Do social cognitive theory constructs increase adult physical activity at vigorous levels of intensity?

- H₀₁₁ Social cognitive theory constructs will not increase adult physical activity at vigorous levels of intensity.
- H₁₁ Social cognitive theory constructs will increase adult physical activity at vigorous levels of intensity.
- H₀₁₂ Peer support will not increase adult physical activity at vigorous levels of intensity.
- H₁₂ Peer support will increase adult physical activity at vigorous levels of intensity.
- H₀₁₃ Familial support will not increase adult physical activity at vigorous levels of intensity.
- H₁₃ Familial support will increase adult physical activity at vigorous levels of intensity.
- H₀₁₄ Self-efficacy will not increase adult physical activity at vigorous levels of intensity.
- H₁₄ Self-efficacy will increase adult physical activity at vigorous levels of intensity.
- H₀₁₅ Mobile fitness app support will not increase adult physical activity at vigorous levels of intensity.
- H₁₅ Mobile fitness app support will increase adult physical activity at vigorous levels of intensity.

Supporting Research Question: Research Question Four

Do social cognitive theory constructs increase the number of days spent engaged in muscle strength training?

H₀₁₆ Social cognitive theory constructs will not increase the number of days spent engaged in muscle strength training.

H₁₆ Social cognitive theory constructs will increase the number of days spent engaged in muscle strength training.

H₀₁₇ Peer support will not increase the number of days spent engaged in muscle strength training.

H₁₇ Peer support will increase the number of days spent engaged in muscle strength training.

H₀₁₈ Familial support will not increase the number of days spent engaged in muscle strength training.

H₁₈ Familial support will increase the number of days spent engaged in muscle strength training.

H₀₁₉ Self-efficacy will not increase the number of days spent engaged in muscle strength training.

H₁₉ Self-efficacy will increase the number of days spent engaged in muscle strength training.

H₀₂₀ Mobile fitness app support will not increase the number of days spent engaged in muscle strength training.

H₂₀ Mobile fitness app support will increase the number of days spent engaged in muscle strength training.

Key Variables

Dependent variables. The current study utilized four dependent variables, one dichotomous measure of physical activity and three continuous measures of physical activity. For the purpose of this study, physical activity was conceptualized as any structured or unstructured physical undertaking focused on physical fitness (HHS, 2008; WHO, 2011). The current national recommendations for physical activity (HHS, 2008) indicate that adults should

participate in a weekly minimum of 150 minutes of aerobic activity at a moderate level of intensity or 75 minutes of vigorous aerobic activity per week. Adults are additionally advised to participate in at least two days a week of full-body strength training. Therefore, the national recommendations were used to operationalize the dichotomous dependent variable; accordingly, the dichotomous dependent variable was operationalized as whether or not a participant met the minimum national recommendations for physical activity.

A dichotomous dependent variable will provide an indication of whether a participant met the minimum national recommendations for physical activity. However, the examination of a continuous dependent variable may allow for a deeper understanding of the data (Altman & Royston, 2006). For example, there may be a meaningful difference between participants who participate in 75 minutes and those who participate in 150 minutes of weekly vigorous aerobic activity. Yet, those participating in the aforementioned levels would be categorized as being the “same” with a dichotomous dependent variable. Therefore, physical activity was also be operationalized with three continuous measures of self-reported activity levels: 1) physical activity at moderate levels of intensity; 2) physical activity at vigorous levels of intensity; and 3) the number of days engaged in muscle strength training. Moderate levels of intensity referred to activities such as a leisurely bicycle ride and doubles tennis, which can usually be accomplished with moderate amount of energy expenditure. In contrast, vigorous intensity referred to activities that oftentimes require a significant amount of energy and effort, such as fast bicycling or singles tennis.

Independent variables. The independent variables for the study will include mobile fitness app support, peer support, family support, and self-efficacy. *Mobile fitness app support* was defined as perceived motivation obtained by participating in the social media component of

mobile fitness apps; operationalization of the construct included survey questions to examine emotional support, comparison to normative behaviors, vicarious experiences, companionship support, and informational support received from mobile fitness apps. *Family support* was defined as motivation given by family members to encourage or support physical activity (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Family support was operationalized with two variables, a generalized family support variable, and a measure of support provided by the physical activity behaviors of the participants' significant others (Berge et al., 2012). The indicators associated with family support included companionship and emotional support. *Peer support* was defined as motivation provided by friends, classmates, teammates, or co-workers (Sallis et al., 1987). Peer support was made operational by indicators of companionship and emotional support (Frank et al., 2010; Sallis et al., 2009). *Self-efficacy*, defined as a person's perception of his or her ability to be successful at a given task (Bandura, 1989), was operationalized with questions that pertain to situations that may make physical activity participation difficult (Bandura, 1977, 2006a).

CHAPTER 3: METHODOLOGY

This chapter discusses the methodology for the study. A description is provided for the procedures, the sample, and the sampling process. The research design is also described, as well as the instruments used to measure the study variables. The chapter concludes with an explanation of the data conversion procedures following data collection.

Sample and Procedures

The researcher's dissertation committee and the university Institutional Review Board (IRB) approved the study and the instrumentation prior to the start of data collection. See Appendix A for a copy of the IRB approval. Data collection began on September 29, 2015 and concluded on March 31, 2016. The data were collected using Qualtrics (2016), an online survey software company. The online survey company provided a web address composed of randomly generated letters and numbers. However, the researcher purchased a domain name and linked the domain address to the online survey software for easier dissemination. See Appendix B for a copy of the online survey.

Sample

The researcher utilized a non-probability snowball sampling method to obtain participants for the study. The participants consisted of social media users over the age of 18. The survey was disseminated through social media and with the assistance of app developers. The owner of JeFit, a general fitness app, agreed to post a link to the survey on the company's social media sites and web forums. In addition, Wodify, a company that developed a fitness app for CrossFit participants, sent an email to its customers with a link to the online survey and posted the link on the company's social media sites. The researcher also posted a link to the survey on social media sites, such as Facebook, Twitter, and various fitness forums. In an

attempt to increase the sampling pool, the researcher included statements such as “please feel free to share this survey” on all social media posts.

Informed consent

The first screen of the online survey contained a consent form, information about the study, and contact information for the primary investigator. The consent form indicated that the survey was completely anonymous. Therefore, no identifying information would be requested. By progressing past the first screen, participants were informed they would be consenting to participate in the study. Participants were also informed that the results of the study might be published. However, results would only appear in aggregate form, and individual surveys would not be released unless required by law. See Appendix A for a copy of the informed consent.

Instrumentation

Dependent Variables

Physical activity was measured using four questions from the International Physical Activity Questionnaire: Short Form ([IPAQ]; Craig et al., 2003). Participants were asked to indicate how many of the past seven days they participated in moderate physical activities and vigorous physical activities. Participants were also asked how long, in hours and minutes, they spent being physically active at each intensity level. An additional question, “During the last 7 days, on how many days did you do muscle strengthening activities, such as squats or triceps extensions?” was also included based on the 2008 national recommendations for physical activity (HHS, 2008).

Independent Variables

Bandura recommended that researchers not rely on a universal measure of self-efficacy (Bandura, 2006a). Put differently, a person’s self-efficacy for physical activity may be different

than his/her self-efficacy for keeping a healthy diet. Instead, Bandura (1997) advocated for the use of self-efficacy instruments specific to the construct being measured. For this reason, Bandura (1997, 2006a) presented self-efficacy scales for various constructs, including physical activity. Thus, *self-efficacy* was measured using Bandura's (1997, 2006a) Self-efficacy to Regulate Exercise scale. The 18-item instrument assessed the degree to which each participant felt he or she would be able to continue being physically active during challenging times. For example, one of the self-efficacy indicators was "when I am feeling tired." Participants were asked to type in their degree of confidence on a scale of 0 "cannot do at all" to 100 "highly certain can do."

Familial and peer support systems were measured using an abbreviated six-item version of the Social Support for Exercise Survey developed by Sallis and associates (1987). The abbreviated version was previously used in The Neighborhood Quality of Life Study ([NQLS]; Frank et al., 2010; Sallis et al., 2009). Participants were asked three questions for each variable, "During the past three months my family, or friends: did physical activity with me; offered to do physical activity with me; and gave me encouragement to do physical activity." Response options were on a five point Likert style scale, ranging from "never" to "very often."

Three survey questions were used to operationalize *Significant other's physical activity behavior*. First, the participants were asked to indicate their relationship status. Participants who did not report being single were also asked two questions from Berge and colleagues' (2012) study regarding their significant other's physical activity behaviors. The two questions were "My significant other plays sports or does something active" and "My significant and I do active things together." Response options were a five-point Likert style scale ranging from "never" to "all of the time." A new composite variable was generated for the analysis: "0" reflected those

participants who did not report having a significant other, and values “1-5” represented the mean of the activity levels indicated in each of the questions from Berge and colleagues’ (2012) study.

No existing instruments were located to examine the *mobile fitness app support* construct, which was not surprising given that no studies have examined the social media component of mobile fitness apps. Therefore, six items were developed by the researcher to explore the construct. Social cognitive theory was used as a framework in the development of the items. For example, logging on specifically to see what others have posted provided a measure of support through vicarious experiences; viewing forums or asking questions examined informational support; and comparing personal workouts to a friend’s workout offered a measure of validation support. An example of an item in the scale is “How often do you view the social media components embedded within mobile fitness apps? (For example, logging on specifically to see what has been posted by others).” A five-point Likert style scale ranging from “never” to “very often” was provided as response options for five of the items. One item, “Interacting with people through my mobile fitness app motivates me to continue participating. (For example, comments left from friends and liking photos),” utilized a different set of Likert style response options. Possible responses were “not at all like me,” “not like me,” “not much like me, neutral,” “somewhat like me,” “like me,” and “just like me.”

Control Variables

Existing literature has provided insight into how demographic variables, such as age, race, gender, and education may influence the effects of social cognitive constructs on physical activity (Dishman et al., 2002; Edwardson et al., 2014; Kirby et al., 2011). Thus, the aforementioned variables were used as control variables, or variables accounted for in a model to allow for clarification on the independent variables. *Education level* was represented by an

ordinal variable ranging from “less than a high school diploma” to “doctoral degree.” *Age* was a continuous variable represented by a participant’s self-reported age. *Race* was represented by a categorical variable. Possible responses for race included “African American/Black,” “Caucasian/White,” “Asian/Pacific Islander,” “American Indian/Alaska Native,” “Multiracial,” and “Other.” A nominal variable was created to account for *gender*. Possible responses for the *gender* variable included “male,” “female, and “gender non-conforming.”

Data Conversion Procedures

Physical Activity Variables

The IPAQ (Craig et al., 2003) was used to create one dichotomous and three continuous measures of physical activity, which were used as the dependent variables for the study. Tables 1, 2, and 3 provide a graphical representation of the data conversions. The survey responses yielded the following seven continuous variables: daily hours engaged in physical activity at a moderate intensity (variable A), daily minutes engaged in physical activity at a moderate intensity (variable C), number of days engaged in physical activity at a moderate intensity (Variable E), daily hours engaged in physical activity at a vigorous intensity (variable G), daily minutes engaged in physical activity at a vigorous intensity (variable I), number of days engaged in physical activity at a vigorous intensity (variable K), and number of days engaged in muscle strength training (variable M).

Given that the moderate and vigorous intensity variables were in hour and minute units, they had to be converted to a standardized unit of time. The variables were converted to minutes to remain consistent with the national physical activity recommendations (HHS, 2008). Step one of the data conversion process was to convert the daily hours engaged in moderate- (variable A) and vigorous- (variable G) intensity activities to minutes, which was completed by multiplying

the two variables by 60. Step two included adding the newly converted minute unit variables (variables B and H) to the existing variables in minute units (variables C and I, respectively). Therefore, the new variables reflected the total number of minutes engaged in moderate- (variable D) and vigorous- (variable J) intensity physical activity. To finalize the data conversion, the total number of minutes engaged in moderate- (variable D) and vigorous- (variable J) intensity physical activity was multiplied by the number of days engaged in moderate- (variable E) and vigorous- (variable K) intensity physical activity, respectively. The resultant variables comprised two of the three continuous dependent variables. One continuous dependent variable reflected the weekly minutes engaged in physical activity at a moderate intensity (variable F), and one continuous dependent variable reflected the weekly minutes engaged in physical activity at a vigorous intensity (variable L). The third continuous dependent variable did not require any data conversion and was represented by the number of days engaged in muscle strength training (variable M).

Table 1. Operationalization of Continuous Dependent Variable: Moderate Intensity

Variable Label	Variable
A	Daily hours engaged in physical activity at a moderate intensity
B	Daily hours engaged in physical activity at a moderate intensity: Converted to minutes
C	Daily minutes engaged in physical activity at a moderate intensity
D	Total daily minutes engaged in physical activity at a moderate intensity
E	Days engaged in physical activity at a moderate intensity
	Step 1: $A * 60 = B$
	Step 2: $B + C = D$
	Step 3: $D * E = F$
F	Weekly minutes engaged in physical activity at a moderate intensity (continuous dependent variable)

Table 2. Operationalization of Continuous Dependent Variable: Vigorous Intensity

Variable Label	Variable
G	Daily hours spent in physical activity at a vigorous intensity
H	Daily hours spent in physical activity at a vigorous intensity: Converted to minutes
I	Daily minutes engaged in physical activity at a vigorous intensity
J	Total daily minutes engaged in physical activity at a vigorous intensity
K	Days engaged in physical activity at a vigorous intensity
	Step 1: $G * 60 = H$ Step 2: $H + I = J$ Step 3: $J * K = L$
L	Weekly minutes engaged in physical activity at a vigorous intensity (continuous dependent variable)

The dichotomous dependent variable (see Table 3) represented physical activity at the nationally recommended levels for substantive health benefits. The dichotomous dependent variable was coded “0” if a participant did not participate at levels that met the national recommendations, and “1” if a participant did participate at levels that met the national recommendations. Therefore, to be coded “1”, a participant must have participated in 1) at least 150 weekly minutes of physical activity at a moderate intensity (as specified by variable F), or 2) at least 75 weekly minutes of physical activity at a vigorous intensity (as specified by variable L), and 3) at least two days of muscle strength training (as specified by variable M). Hence, all three of the continuous dependent variables were used to create the dichotomous dependent variable.

Table 3. Operationalization of Dichotomous Dependent Variable

Variable Label	Variable
F	Weekly minutes engaged in physical activity at a moderate intensity
L	Weekly minutes engaged in physical activity at a vigorous intensity
M	Days engaged in muscle strength training
	Step 1: Create new variable (Variable N) Step 2: If $F \geq 150$ and $M \geq 2$ then N will be coded “1”

(Table 3 continued)

Step 3: If $L \geq 75$ and $M \geq 2$ then N will be coded “1”

Step 4: All other observations coded “0”

Physical activity at the nationally recommended levels for substantive health benefit

N

“0” = does not meet national recommendations

“1” = meets national recommendations

Self-efficacy

Although Bandura’s (Bandura) Self-efficacy to Regulate Exercise scale has been used and validated with a number of populations (Everett, Salamonson, & Davidson, 2009; Shin, Jang, & Pender, 2001; van der Heijden, Pouwer, Romeijnders, & Pop, 2012), Bandura postulated “There is no single validity coefficient” (Bandura, 2006a, p. 319). Bandura postulated “There is no single validity coefficient” (Bandura, 2006a, p. 319). Instead, Bandura advocated that researchers examine validity coefficients during every study. The reason for this recommendation is because self-efficacy is an ever-evolving construct. Consequently, the factors that affect self-efficacy may be continuously changing (Bandura, 2006a).

Bandura’s (2006a) recommendations were followed to inspect the scale and construct the self-efficacy variable. Thus, inter-item reliability was established using Chronbach’s (1950, 1951, 2004) alpha coefficients (α), and a factor analysis was conducted to examine the 18-item scale. An alpha higher than 0.80 was desired (George & Mallery, 2005); however, since Bandura (2006a) has suggested that self-efficacy is ever-evolving, an alpha of 0.6 to 0.8 would have been considered acceptable. Had any questions not correlated well (as indicated by $\alpha \leq .60$), they would have been removed. The factor analysis was used to explore whether the number of latent variables explained by the 18-item scale (Tabachnick & Fidell, 2007). An Eigen value of “1” or higher was used to identify the latent variables; however, given existing literature (Bandura,

2006a), only one factor was expected. A new variable was generated based on the factor scores, and an ordinal variable was created to differentiate low to high levels of self-efficacy.

Mobile Fitness App Support

Just as Bandura (Bandura) hypothesized that self-efficacy is an ever-evolving construct; it likely that mobile fitness app support will continue to evolve as technology develops. For this reason the analysis for the mobile fitness app support variable was similar to that of self-efficacy. Following data collection, inter-item reliability was established using Chronbach's alpha, and a factor analysis was conducted to explore reducing the six-item scale. An Eigen value of "1" was used in the factor analysis to identify latent variables explained by the six items. Given that the items were grounded in theory, they were expected to be highly correlated and to represent one latent variable. However, items that were not correlated as expected ($\alpha \leq 0.60$) would have been removed. A new variable was generated based on the factor scores, and an ordinal variable was created to differentiate low to high levels of mobile fitness app support.

Familial and Peer Support

Based on the instrument scoring instructions, the three family questions from the Social Support for Exercise Survey (Sallis et al., 1987) were used as a three-item subscale measure of family support, and the three peer questions were used as a three-item subscale measure of peer support (Sallis et al., 1987). The responses in each subscale were summed thereafter, and the average was calculated to generate composite peer support and family support variables to use in the analysis. The range of scores for the two composite variables could be 0-4.

CHAPTER 4: ANALYSIS AND RESULTS

This chapter describes the analysis and presents the results for the study. To start, the data mining procedures are explained, followed by descriptive statistics for each variable in the study. Depending on the type of variable, univariate statistics may include means, standard deviations, ranges, and percentages. Bivariate analyses are presented for each independent variable in relation to the dependent variable. Four multivariate analyses are also described: one logistic regression and three ordinary least squares (OLS) regressions. Long and Freese's (2005) post estimation commands were used to generate the predicted probabilities that are presented and discussed in relation to the significant independent variables in the logistic regression model. The data were analyzed using Stata 12 (StataCorp, 2015), and an alpha level of 0.05 was used to determine significance for all analyses.

Data Management

The original sample consisted of 646 responses. The data mining process began by exporting the data from the online survey site into a spreadsheet. Nonessential cells were removed from the dataset, and the variable names were recoded to correspond with the current study. Although 646 responses were collected from the online survey, the final sample for the analyses consisted of 467 responses. A number of factors contributed to the removal of 179 observations. For example, 149 observations were eliminated because the participants did not finish the survey, of which 100 participants stopped participating at the self-efficacy scale. The other 49 participants stopped at various places in the survey. Thirty observations were dropped from the analyses because of missing data or because there was no variation among the remaining study variables. For example, one participant did not report his age; six participants did not specify their racial identification; and thirteen participants left the physical activity

questions blank. Only one respondent self-identified as gender non-conforming; thus, the observation was dropped from the analysis since the small response rate could have biased the results. An additional seven participants identified as American Indian; however, the logistic regression analysis removed the observations because there was no variation in the responses. In a similar way, there was no variation in the responses from the two participants who reported not having a high school equivalency. Therefore, the responses were eliminated from the final analyses. Aside from the aforementioned reasons for exclusion, the eliminated responses did not differ from the final sample, which will be described in the next section.

Descriptive Statistics

The following section describes the variables used in the analyses. First, the control variables will be used to provide demographic information about the study participants: age, race, gender, and education level. Second, the independent/predictor variables are discussed: self-efficacy, mobile fitness app support, peer support, family support, and significant other's physical activity behavior. Lastly, the dependent variables are described in relation to the specific multivariate analyses performed.

Demographic/Control Variables

The following variables are presented to provide demographic information about the study participants: age, race, gender, and education level (see Tables 4 and 5). The participants ranged in age from 19 to 70 years old. The mean (M) age of the sample was 35.8 years with a standard deviation (SD) of 9.6 years. The mode, or the age most represented in the sample, was 34 years of age ($n = 33$; 7.07%). The typical participant was White/Caucasian (85.22%), female (62.96%), and had a college degree (associates: 8.14%; bachelors: 39.40%; masters: 24.41%; doctorate: 8.99%). Seven (1.5%) participants selected "Other" as a response to the education

question. Participants who choose “Other” were prompted to “please specify” what “Other” meant by typing into a short answer box provided in the survey. Upon examination of the short answer responses, all seven of the participants specified educational endeavors that required a high school equivalency, but no college degree, such as personal trainer certifications. Rather than dichotomizing the education responses for the analysis, education was represented by an ordinal variable ranging from “high school” to “doctoral degree,” with “other” being placed between “high school” and “some college.”

Table 4. Demographic Statistics: Race, Gender, and Education

	Number	Percent
Race		
White	398	85.22%
Black	22	4.71%
Asian/PI	15	3.21%
Multiracial	15	3.21%
Hispanic/Latino	17	3.64%
Gender		
Male	173	37.04%
Female	294	62.96%
Education		
High School	14	3.00%
Other	7	1.50%
Some College	68	14.56%
Associates	38	8.14%
Bachelors	184	39.40%
Masters	114	24.41%
Doctorate	42	8.99%

Note: $n = 467$; PI = Pacific Islander.

Table 5. Demographic Statistics: Age

	Mean	Standard Deviation	Range
Age	35.8	9.6	19-70

Note: $n = 467$.

Self-efficacy

Following Bandura's (2006a) recommendation, reliability and validity estimates were generated for self-efficacy items used in the current study. Based on George and Mallery's (2005) assertion, the scale demonstrated high internal consistency (Cronbach's $\alpha = .96$). A factor analysis was conducted to examine the 18 items in the self-efficacy scale. Only one factor yielded an eigenvalue higher than 1 (eigenvalue = 10.44), which suggested that the 18 items in the scale represented one latent variable; therefore, a new variable was created to collapse the 18 items into one self-efficacy variable. The self-efficacy factor scores ranged from -2.01 to 2.00 (SD = 0.87), which were divided into four categories (see Table 6). A cross-tabulation of factor scores and unfactored self-efficacy scores revealed that participants with factor scores from -2.01 to -1.01 were the same participants with a self-efficacy score of zero (0); therefore, the category was labeled "no self-efficacy" (16.70%; $n = 78$). Factor scores between -1 and -0.01 were labeled "low self-efficacy" (25.70%; $n = 120$); factor scores from 0 and 0.99 were labeled "moderate self-efficacy (47.97%; $n = 224$); and factor scores between 1 and 2 were labeled "high self-efficacy" (9.64%; $n = 45$).

Table 6. Descriptive Statistics: Self-efficacy

	Number	Percent
Self-efficacy		
No self-efficacy	78	16.70%
Low self-efficacy	120	25.70%
Moderate self-efficacy	224	47.97%
High self-efficacy	45	9.64%

Note: $n = 467$.

Mobile Fitness App Support

The reliability co-efficient for the six items to assess mobile fitness app support was .89, which indicated acceptable internal consistency. A factor analysis was also conducted with six

items in the mobile fitness app support scale, the result of which was a single factor with an eigenvalue of 3.54. Thus, a new variable was created to represent mobile fitness support in analyses (see Table 7). The factor scores in the mobile fitness app support variable ranged from -1.18 to 2.53, which were divided into three categories. Participant factor scores ranging from -1.18 to -0.4372943 were labeled as “low support” (36.19%; $n = 169$); factor scores between -0.4372944 and 0.3050871 were labeled as “moderate support” (31.26%; $n = 146$); and factor scores from 0.3050872 to 2.53 were labeled as “high support” (32.55%; $n = 152$).

Table 7. Descriptive Statistics: Mobile Fitness App Support

	Number	Percent
Mobile Fitness App Support		
Low support	169	36.19%
Moderate support	146	31.26%
High support	152	32.55%

Note: $n = 467$.

Peer and Family Support

The six-item social support for exercise survey (Sallis et al., 1987) was used to create the peer support and the family support variables. The peer support variable was represented by the mean of the three peer support items. Likewise, the mean of the three family support items represented the family support variable. The participants chose from a five-point Likert scale for each of the six questions in the social support for exercise scale, which were coded 0, 1, 2, 3, or 4. After calculating the mean, the new variables each became 13-point ordinal scales (see Figure 1), ranging from low support to high support: 0, 0.33, 0.66, 1, 1.33, 1.66, 2, 2.33, 2.66, 3, 3.33, 3.66, 4. The family support scale had a high level of internal consistency, as determined by a Cronbach’s alpha of 0.90. The peer support scale yielded a slightly higher level of internal consistency, as determined by a Cronbach’s alpha of 0.94.

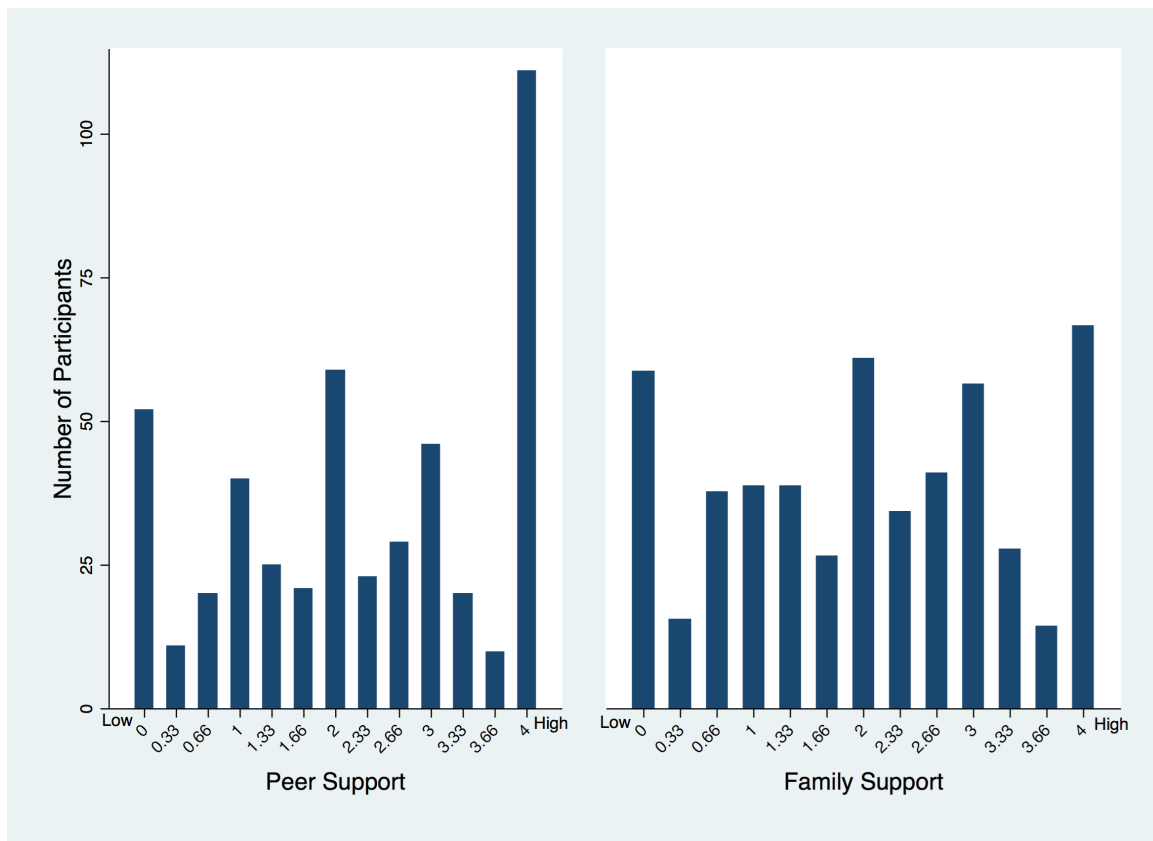


Figure 1. Distribution of Scores for Family and Peer Support Variables.

Significant Other's Physical Activity Behavior

The significant other's physical activity behavior variable was reflective of three questions pertaining to: 1) relationship status, 2) the level of physical activity for which participant's significant others were involved, and 3) how often the participants and their significant others participated in physical activity together. The significant other's physical activity items had a high level of internal consistency ($\alpha = 0.90$). Thus, a composite variable was created wherein "0" reflected those participants who reported not having a significant other, and values 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, and 5 represented the mean of the two significant other activity levels questions. The resultant 0 – 5 ordinal variable was further divided into four categories: no significant other, low significant other physical activity behavior, moderate significant other physical activity behavior, and high significant other physical activity behavior

(see Table 8). The category labeled “no significant other” represented those participants who reported having no significant other (16.27%; $n = 76$); the “low significant other physical activity behavior” category reflected the values coded 1, 1.5, and 2 (24.84%; $n = 116$); the “moderate significant other physical activity behavior” category reflected the values coded 2.5, 3, and 3.5 (42.83%; $n = 200$); and the “high significant other physical activity behavior” reflected the values coded 4, 4.5, and 5 (16.06%; $n = 75$).

Table 8. Descriptive Statistics: Significant Other’s Physical Activity Behavior

	Number	Percent
Significant Other’s PA Behavior		
No Significant Other	76	16.27%
Significant Other’s Physical Activity Behavior: Low	116	24.84%
Significant Other’s Physical Activity Behavior: Moderate	200	42.83%
Significant Other’s Physical Activity Behavior: High	75	16.06%

Note. $n = 467$.

Physical Activity

The current study utilized one dichotomous and three continuous dependent variables. Following data collection, physical activity for the previous week was calculated for both moderate and vigorous physical activity by multiplying the number of days active by the sum of the hours and minutes spent doing physical activity each day (refer to Tables 1 and 2). The total number of weekly minutes involved in moderate ($M = 132.15$; $SD = 168.83$; range = 0 – 840) and vigorous physical activities ($M = 180.17$; $SD = 193.61$; range = 0 – 1155) was used as two continuous dependent variables for the multivariate regression analyses (see Table 9). An additional continuous dependent variable was represented by the total number of days engaged in muscle strength training ($M = 2.73$; $SD = 2.18$; range = 0 – 7).

Table 9. Descriptive Statistics: Continuous Measures of Physical Activity

	Mean	Standard Deviation	Range
Physical Activity (minutes)			
Moderate Intensity	132.15	168.83	0-840
Vigorous Intensity	180.17	193.61	0-1155
Physical Activity (days)			
Strength Training	2.73	2.18	0-7

Note: $n = 467$.

The dichotomous dependent variable (see Table 10) represented physical activity at the nationally recommended levels for substantive health benefits. Based on the data, 248 (53.10%) of the participants engaged in physical activity at levels that met the national recommendations. In contrast, the activity levels of 219 participants (46.90%) did not meet the national recommendations.

Table 10. Descriptive Statistics: National Recommendations

	Number	Percent
Physical Activity		
Met national recommendations	248	53.10%
Did not meet national recommendations	219	46.90%

Note: $n = 467$.

Bivariate Analyses

This section will describe parametric and nonparametric tests used to explore bivariate measures of association between the dependent and independent study variables. For parametric data, Pearson's r (Pearson, 1895) was employed to examine relationships between continuous variables. Nonparametric tests included Spearman's rho (ρ), Cramer's V (ϕ_c), point biserial correlations (t), Eta (η^2), and Somer's d (Tabachnick & Fidell, 2007). Spearman's rho (Lovie, 1995; Spearman, 1904) was applied to determine significance when one variable was continuous and the other was ordinal; Cramer's V (Cramér, 1946) provided measures of association for

nominal variables; Somer's d (Somers, 1962) was used with ordinal and dichotomous nominal variables; point biserial correlations (Kornbrot, 2005) were employed with continuous and dichotomous variables; and Eta (Cohen, 1973; Pearson, 1896) was used to measure relationships between continuous and categorical variables.

National Recommendations

With respect to physical activity at the nationally recommended levels for substantive health benefits, bivariate measures consisted of tests for Somer's D, Cramer's V, and point biserial correlations. Statistically significant relationships were found with seven variables: self-efficacy (Somer's D = 7.17, $p < 0.05$), mobile fitness app support (Somer's D = 5.73, $p < 0.05$), peer support (Somer's D = 7.42, $p < 0.05$), family support (Somer's D = 5.39, $p < 0.05$), significant other's physical activity behavior (Somer's D = 5.30, $p < 0.05$), education (Somer's D = -2.74, $p < 0.05$) and gender ($\phi_c = -0.15$, $p < 0.05$). That is to say, no relationships were found between physical activity at the nationally recommended levels for substantive health benefits and race ($\phi_c = 0.07$, $p > 0.05$), or age ($t = -1.55$, $p > 0.05$).

Vigorous Intensity

For physical activity at vigorous intensity, the analysis revealed significant associations with seven variables: education ($\rho = -0.10$, $p < 0.05$), peer support ($\rho = 0.35$, $p < 0.05$), family support ($\rho = 0.18$, $p < 0.05$), self-efficacy ($\rho = 0.27$, $p < 0.05$), mobile fitness app support ($\rho = 0.25$, $p < 0.05$), significant other's physical activity behavior ($\rho = 0.20$, $p < 0.05$), and gender ($t = -2.86$, $df = 450$, $p < 0.05$). Conversely, there were no significant relationships with the age ($r = -0.2$, $p > 0.05$) or race ($\eta^2 = 0.01$, $p > 0.05$) variables.

Moderate Intensity

Significant relationships between study variables and physical activity at moderate intensities differed slightly compared to those at vigorous intensities. The analysis revealed significant associations with five variables: peer support ($\rho = 0.16, p < 0.05$), family support ($\rho = 0.15, p < 0.05$), self-efficacy ($\rho = 0.17, p < 0.05$), mobile fitness app support ($\rho = 0.15, p < 0.05$), and race ($\eta^2 = 0.21, p < 0.05$). In contrast, no significant correlations were revealed for education ($\rho = -0.03, p > 0.05$), significant other's physical activity behavior ($\rho = 0.09, p > 0.05$), gender ($t = -1.95, df = 450, p > 0.05$), or age ($r = 0.04, p > 0.05$).

Strength Training

For days engaged in strength training, the analysis revealed significant relationships with eight variables: education ($\rho = -0.15, p < 0.05$), peer support ($\rho = 0.41, p < 0.05$), family support ($\rho = 0.21, p < 0.05$), self-efficacy ($\rho = 0.25, p < 0.05$), mobile fitness app support ($\rho = 0.33, p < 0.05$), significant other's physical activity behavior ($\rho = 0.22, p < 0.05$), gender ($t = -4.88, df = 449, p < 0.05$), and age ($r = -0.11, p < 0.05$). No significant relationship was observed between strength training and race ($\eta^2 = 0.02, p > 0.05$).

Support Variables

Two variables, family support and significant other's physical activity behavior, were included in the analysis to measure familial support. A chi-squared test was used to examine whether both variables measured the same phenomenon. The chi-squared test ($\chi^2 = 259.98, df = 36, p < 0.05$) indicated that the two variables were statistically different, which suggested that the variables were orthogonal; that is to say, a participant may have perceived a high (or low) level of support from family members, while at the same time having a significant other with a low (or high) activity score.

The analysis also included two variables related to peer support: peer support and mobile fitness app support. A chi-squared test ($\chi^2 = 100.41$, $df = 24$, $p < 0.05$) indicated that the two variables were statistically independent. Similar to familial support, a participant may have perceived a high (or low) level of support from mobile fitness apps, while at the same time perceiving low (or high) support from peers.

Logistic Regression Analysis

This section will present the findings of a logistic regression analysis (logit) used to answer the first research question, which sought to test the predictive power of social cognitive theory constructs in relation to the national recommendations for adult physical activity. Logit is a nonlinear regression that yields log odds ratios used to generate predicted values that stay within the confines of a discrete (0-1) dependent variable (Tabachnick & Fidell, 2007). The interpretation of a logit coefficient is as follows: While controlling for all other variables, a one unit change in the independent variable results in a b unit change in the log odds ratio that the dependent variable is 1 (Long & Freese, 2005).

The current logit model (see Figure 2) examined the following independent variables: mobile fitness app support, peer support, family support, significant other's physical activity behavior, and self-efficacy. Education, age, race, and gender were also included in the model as control variables. Positive relationships were expected for self-efficacy, peer support, family support, and significant other's physical activity behavior. Given that no known research had examined the predictive value of the social media component of mobile fitness apps, the direction and significance level for this construct was unknown. Statistical significance was determined by examining p values; an alpha, or significance level, of 0.05 was used as the threshold for statistical significance.

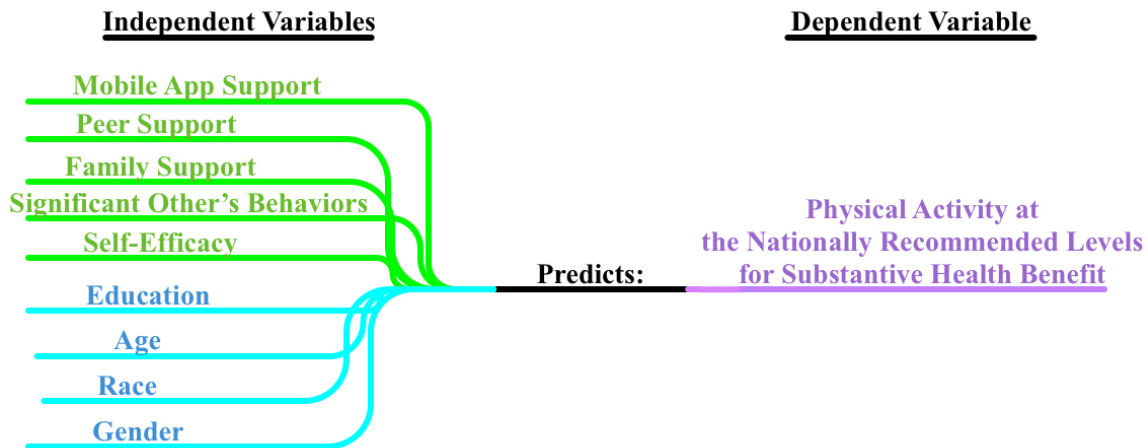


Figure 2. Logistic Regression Model

Logistic Regression Results

The logit model (see Table 11) had a statistically significant χ^2 statistic (111.20, $p < 0.05$) and produced a McFadden's pseudo R^2 of 0.17. Based on this information, the null hypothesis that the model did not explain any of the variation in the dependent variable was rejected. The model produced four independent variables that met statistical significance at the .05 level: self-efficacy ($b = 0.652$), mobile fitness app support ($b = 0.280$), peer support ($b = 0.273$), and significant other's physical activity behavior ($b = 0.290$). Three control variables also met statistical significance at the .05 level: age ($b = -0.021$), gender ($b = -0.419$), and education ($b = -0.177$). With the exception of education, all of the significant variables yielded coefficients in the anticipated direction. On the other hand, one independent variable and four control variables did not reach significance at the .05 level: family support ($b = 0.110$), Black/African American participants ($b = -0.327$), Asian participants ($b = 0.348$), Hispanic/Latino participants ($b = -0.130$), and Multiracial participants ($b = 0.342$). Family support, while not statistically significant, was in the expected directions.

The statistically significant mobile fitness app support variable should be interpreted as follows: A one unit change in mobile fitness app support (while controlling for all other

variables) results in a 0.280 change in the log odds ratio that a participant would have engaged in physical activity behavior at the nationally recommended levels for substantive health benefits. Put differently, as an individual received more mobile fitness app support, the probability of having met the nationally recommended levels increased. This interpretation may be used for each of the statistically significant variables in the model.

Standardized beta coefficients (β) were also calculated to determine which significant variables had the greatest impact on physical activity at the nationally recommended levels. The variable with the greatest impact was self-efficacy ($\beta = 0.27$), followed by peer support ($\beta = 0.17$), significant other's physical activity behaviors ($\beta = 0.13$), education ($\beta = -0.112$), mobile fitness app support ($\beta = 0.108$), gender ($\beta = -0.094$), and age ($\beta = 0.092$).

Table 11. Logistic Regression Estimates

	b	z	β
Self-efficacy***	0.652	5.10	0.27
Peer Support***	0.273	3.07	0.17
Family Support	0.110	1.08	
Significant Other's Physical Activity Behavior**	0.290	2.23	0.13
Mobile Fitness App Support**	0.280	2.01	0.108
Gender**	-0.419	-1.89	-0.094
Age**	-0.021	-1.78	-0.092
Education**	-0.177	-2.21	-0.112
Asian	-0.348	0.56	
Black	-0.327	-0.65	
Hispanic/Latino	-0.129	-0.22	
Multiracial	0.343	0.58	
Constant	-0.727	-1.16	
N	467		
Model χ^2	111.20		
Probability (χ^2)	0.00		
Pseudo R ²	0.17		

Note: ***prob < 0.01, **prob < 0.05, *prob < 0.10

A four-step process was used to make the predicted probabilities to examine model fit and to conduct post estimation analyses: 1) Predictions (values ranging from 0-1) were generated for each participant in relation to the probability of engaging in physical activity at the nationally recommended levels; 2) A new variable was created; 3) The new variable was coded “0” if a participant’s predicted value was below 0.5; and 4) The variable was coded “1” if the predicted value was .50 or above. Thus, participants were predicted to participate in physical activity at the nationally recommended levels if the predicted probabilities met or exceeded a 0.50 threshold.

Model fit. Various measures of fit were assessed to examine logistic regression assumptions and to estimate the suitability of the logit model for this study. The model was first examined for specification errors and multicollinearity. Specification errors refer to errors based on the inclusion or exclusion of variables (Tabachnick & Fidell, 2007). Although theory drove the rationale for the inclusion of each variable in the study, a linktest was conducted to explore possible specification errors in the model. The linktest confirmed that the model did in fact include substantive predictor variables, and that the model did not suffer from specification errors. The model was also inspected for collinearity, which refers to the linear relationship between variables in the study (Tabachnick & Fidell, 2007). When two variables are highly correlated the regression coefficients become unreliable. An examination of tolerance and the variance inflation factor (VIF) ensured that the standard errors were not overinflated, which suggested that the model lacked multicollinearity.

The Hosmer-Lemeshow goodness-of-fit statistic ($\chi^2 = 5.19, p > 0.05$) indicated that the model fit the data well (Hosmer, Lemeshow, & Sturdivant, 2013). The Count R^2 , which provides an estimation of the accurately predicted cases (Long & Freese, 2005), yielded a value of 0.70 (see Figure 3). Put differently, the model accurately predicted 70% of cases in the sample. The

logit model correctly predicted 190 participants who engaged in physical activity at the nationally recommended levels and 137 participants that did not engage in physical activity at the nationally recommended levels. Conversely, 82 participants were predicted to engage in physical activity at the nationally recommended levels, yet did not. An additional 58 participants reported engaging in physical activity at the nationally recommended levels; however, based on the model, they were not predicted to do so.

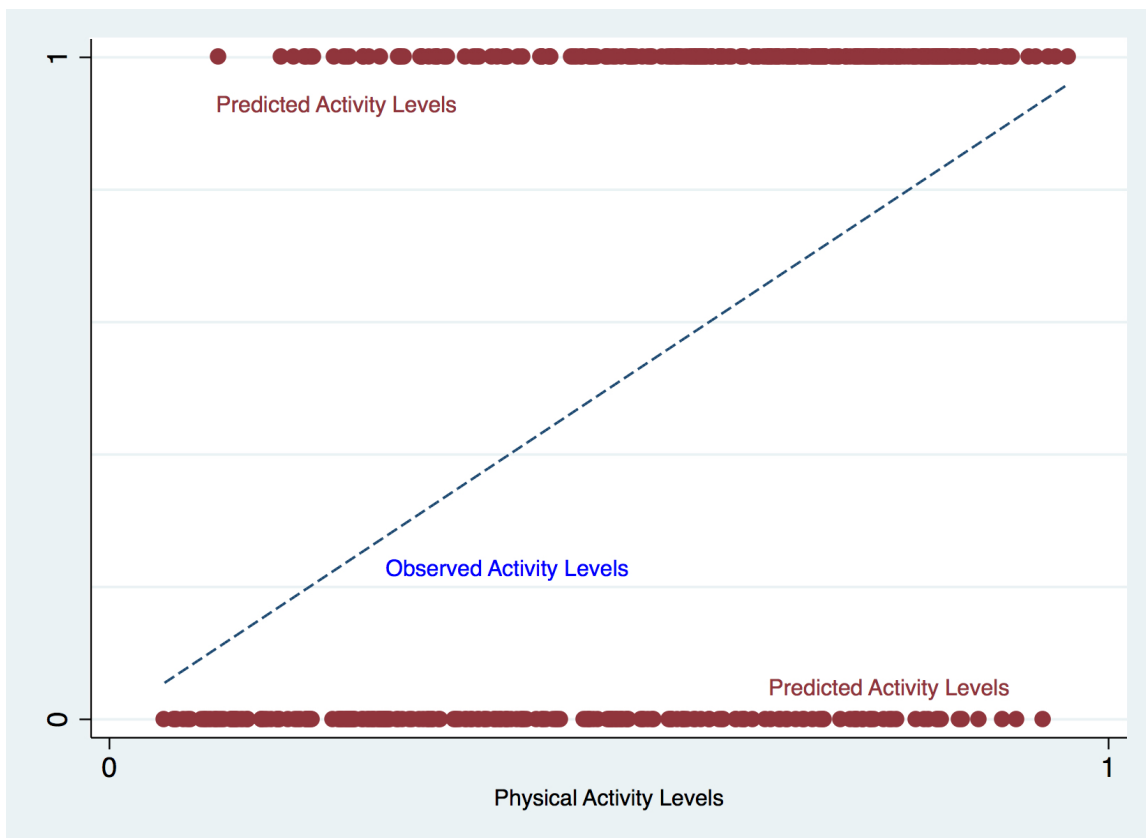


Figure 3: Predicted vs. Observed Values

The proportional reduction in error (PRE) was obtained by examining the Adjusted Count R^2 (Long & Freese, 2005). The Adjusted Count R^2 for the model was 0.361, which means that 36.1% of cases that were mispredicted by the null were accurately predicted by the logit model in this study. Put another way, 33.9% of cases would likely be correctly predicted with any model; however, the model used in the current study correctly predicted an additional 36.1% of

cases. McKelvey and Zavoina's R^2 , which is considered to be the closest R^2 to the traditional R^2 reported in an OLS regression model, was 0.285. Given the values for the Count R^2 (percentage of games accurately predicted), the Adjusted Count R^2 (percentage of case accurately predicted that were missed by the null), and the McKelvey and Zavoina's R^2 (R^2 closest to the traditional OLS R^2), this model should not be considered a perfect fit for predicting physical activity at nationally recommended levels. However, given that no known study has included mobile fitness app support, this model could be useful when developing future studies.

Odds ratios. The odds ratios (OR) and confidence intervals (CI) associated with the seven statistically significant variables were as follows: self-efficacy (OR = 1.92; CI = 1.49 – 2.46), peer support (OR = 1.31; CI = 1.10 – 1.56), significant other's physical activity behaviors (OR = 1.34; CI = 1.04 – 1.73), mobile fitness app support (OR = 1.32; CI = 1.01 – 1.74), gender (OR = 0.66; CI = 0.43 – 1.02), age (OR = 0.98; CI = 0.96 – 1.00), and education (OR = 0.84; CI = 0.72 – 0.98). The interpretation of an odds ratio is as follows: For every one unit change in an independent variable, the odds of engaging in physical activity at the nationally recommended levels is likely to change by a factor of the odds ratio associated with the variable.

Although odds ratios provide an indication of changes in odds based on the independent variables, their interpretive value is limited (Long, 2014). Predicted probabilities allow for the examination of substantive changes in predictions and predictive distributions and allow for investigation of changes in the dependent variable with various starting points for the significant independent variables (Long, 2014). Thus, predicted probabilities have been used to further interpret the results of this study.

Predicted probabilities. The following sections will present predicted probabilities based on the statistically significant variables in the logit model. Similar to the interpretation of a

logit coefficient, readers should note that all predicted probabilities must be interpreted with the understanding that all other variables in the model are held constant at their mean.

Lowest to highest values. The predicted probabilities for each significant independent variable in the model can be found in Figure 4. The predicted probabilities range from lowest to highest, indicating the probability that a participant would engage in physical activity that met the national recommendations for substantive health benefits based on the lowest and highest observations in the model.

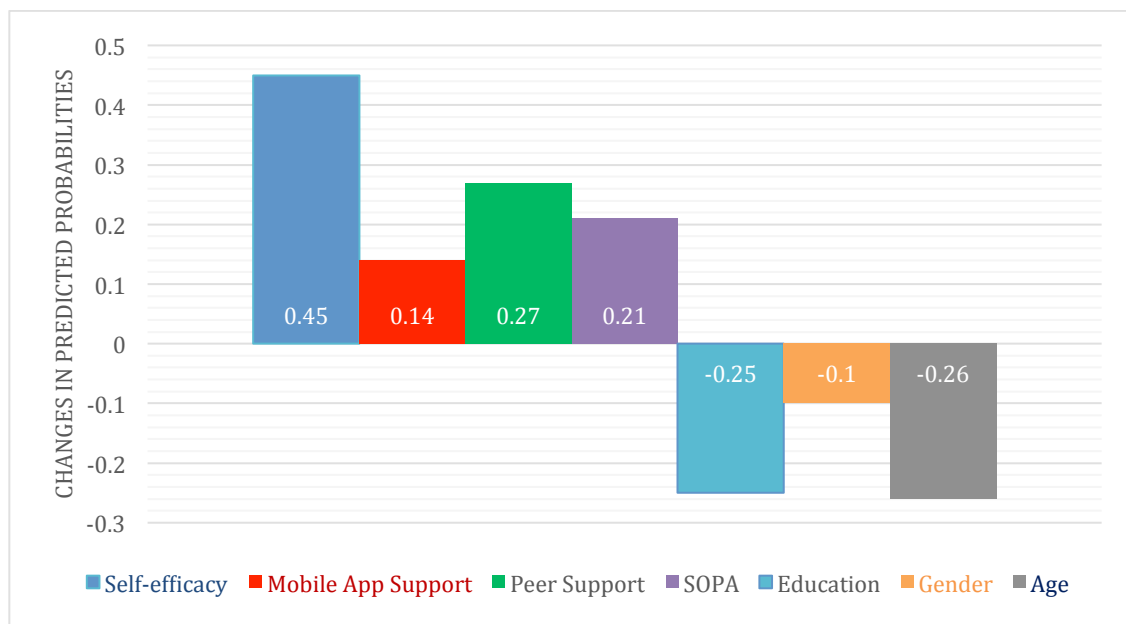


Figure 4. Predicted Probabilities: From Lowest to Highest Values

Self-efficacy was a measure of a person's perception of their ability to be successful at a given task (Bandura, 1989). Based on the model in this study, a participant with the highest level of self-efficacy was 45% more likely to participate in physical activity that met the national recommendations than a participant with the lowest level self-efficacy. The mobile fitness app support variable was a measure of perceived support from mobile fitness apps. Based on the model, a person who never received support from mobile fitness apps was 14% less likely to

participate in physical activity that met the national recommendations than a participant who perceived high levels of support from mobile fitness apps.

Peer support was a measure of perceived support from friends, classmates, teammates, and/or colleagues. Based on these data, participants who perceived the highest levels of peer support were 27% more likely to meet the national recommendations than participants with the lowest level of peer support. Significant other's physical activity behavior was a measure of how often a participant's significant other is physically active combined with how often the couple works out together. The participants in this study who had significant others, whose significant others worked out, and who worked out with their significant others were 21% more likely to meet the national recommendations than participants with the lowest scores.

Changes in the dichotomous gender variable suggested males had a 10% greater probability than females (or 60%, and 50%, respectively) of meeting the national recommendations. Age was a continuous variable that ranged from 19 – 70 years. Based on the model, a 19-year-old participant had a 26% higher probability of meeting the national recommendations than a 70-year-old participant. Lastly, the model predicted that participants with the lowest level of education (high school equivalency) were 25% more likely to meet the national recommendations than participants with the highest level of education (doctorate degree).

Mobile fitness app support. Participants who perceived low levels of support from mobile fitness apps had a 47% chance of meeting the national physical activity recommendations (see Figure 5). The probability rose 7% (54%) for those who reported receiving moderate levels of support and another 6% (60%) for participants who perceived the highest levels of support from mobile fitness apps.

Self-efficacy. The probability of a participant meeting the national physical activity recommendations having reported no perceived self-efficacy was 30% (see Figure 5). However, the likelihood increased to 45% when participants reported even the lowest levels of self-efficacy for exercise. The chances improved to 61% with moderate levels of self-efficacy, and participants with high perceptions of their ability to workout no matter life's obstacles (self-efficacy) had a 75% chance of meeting the national recommendations.

Peer support. The peer support variable had 13 categories ranging from 0 to 4 (see Figure 1). Participants who reported the lowest levels of perceived peer support had a 38% chance of participating at the national recommended levels for substantive health benefits (see Figure 5). Predicted probabilities rose as participants perceived more support. However, participants were not projected to meet the national recommendations until perceived support reached the level categorized by “2” (52%). Participants with the highest levels of perceived support from peers had a 65% chance of participating at the national recommended levels.

Significant other's physical activity. The significant other variable was composed of four categories (see Table 8). The first category represented participants who did not report having a significant other. The predicted probability of participating at the national recommended levels was 42% for participants who did not have a significant other (see Figure 5). Participants who reported having significant others with low levels of physical activity behavior had a 49% chance of meeting the national recommended levels. Participants with significant others classified in the moderate behavior range had a 56% chance of meeting the national recommendations. Lastly, predicted probabilities for participants who reported having significant others who were highly involved had a 63% likelihood of meeting the national recommended levels.

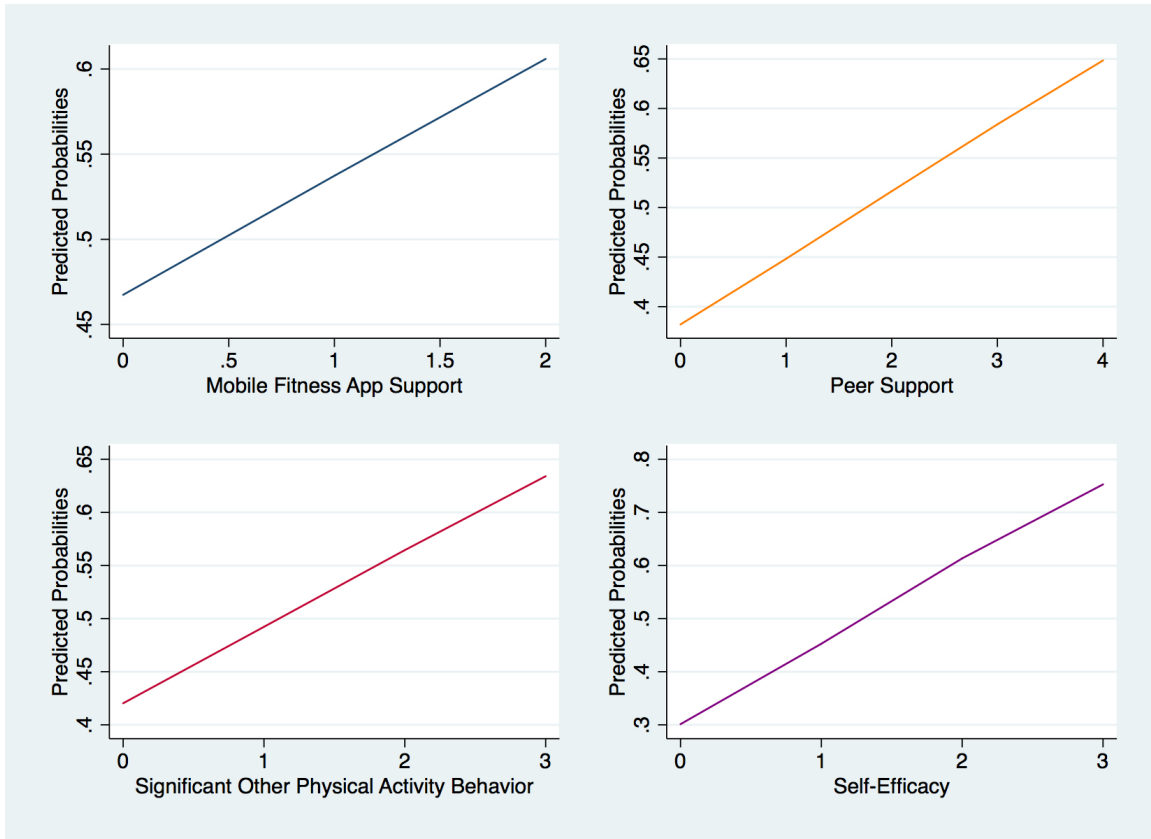


Figure 5. Predicted Probabilities: Mobile Fitness App Support, Peer Support, Significant Other's Physical Activity Behavior, and Self-efficacy

Cross-classifications. The logit model yielded the following significant variables: self-efficacy, mobile fitness app support, peer support, significant other physical activity behavior, age, gender, and education. The following section will provide insight into how the significant variables interacted to alter predicted probabilities for physical activity. For example, as Figure 6 shows, men were predicted to meet the national recommendations with only low levels of support gained from mobile fitness apps (Low support = 53%, moderate support = 60%, high support = 66%). However, females may have required higher levels of mobile fitness app support, as females were not predicted to meet the national recommendations with low levels of mobile fitness app support (Low levels = 43%; moderate levels = 50%; high levels = 57%).

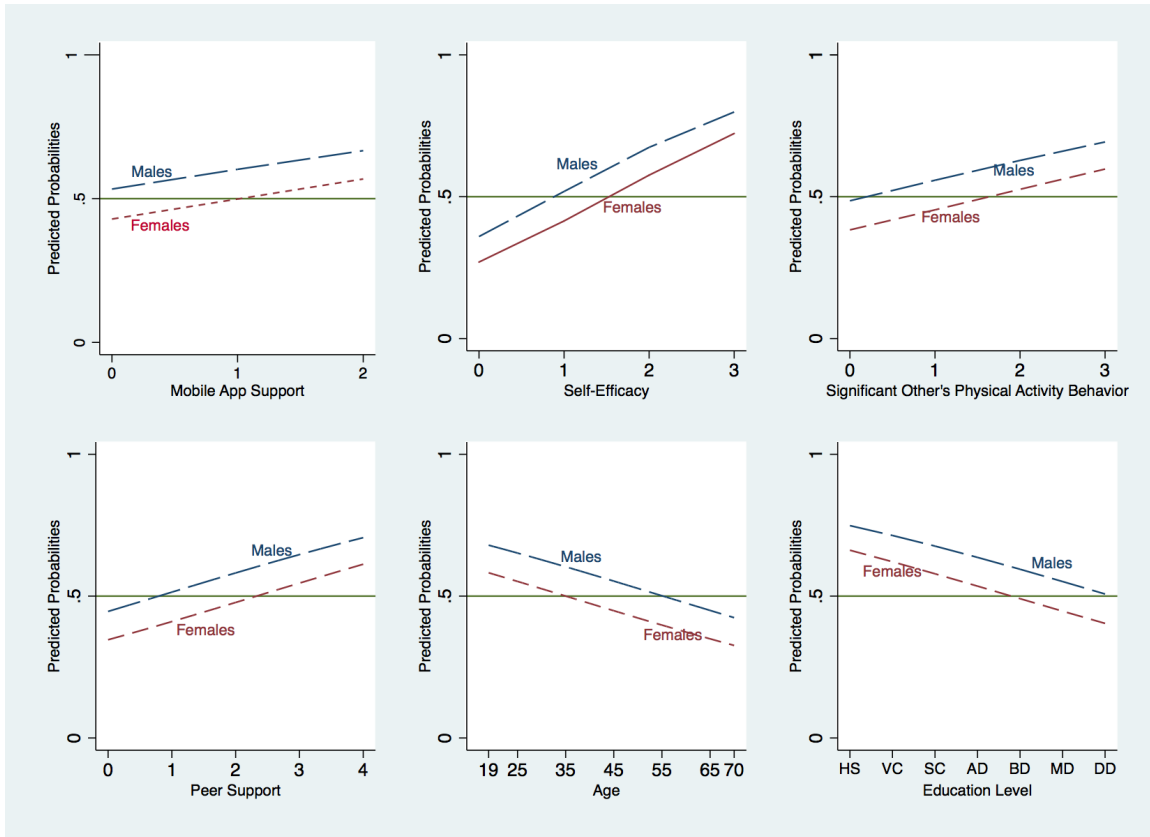


Figure 6. Predicted Probabilities: By Gender

For participants who reported no perceived self-efficacy (0), females were 9% less likely than males to meet the national recommendations (see Figure 6). Males with low perceived self-efficacy (1) met the .5 threshold to be predicted to participate at the nationally recommended levels; however, females were not predicted to exceed the threshold with less than moderate levels of perceived self-efficacy (2). With the highest levels of self-efficacy (3), males had an 80% chance of meeting the national recommendations, while females only had a 72% chance.

Compared to females, these data revealed that males were more influenced by lower levels of physical activity by their significant other (see Figure 6). For instance, neither males nor females were predicted to meet the national recommended levels with no significant other behavior (49% and 38%, respectively). However, with low levels of significant other behavior, males had a 56% chance of meeting the national recommendations, whereas females did not

exceed the threshold with less than moderate levels of significant other physical activity behavior (53%). Consistent with previous research, the findings also suggested that males were more influenced by peer support than females (see Figure 6). The analysis indicated that men were predicted to meet the national recommendations with low levels of support (51%), while females were not predicted to meet the national recommendations with less than moderate levels of support (50%).

The analysis also suggested that age and education differed by gender in relation to whether a participant was predicted to participate in physical activity levels that met the national recommendations (see Figure 6). The youngest (19) males and females were predicted to meet the national recommendations (70% and 58%, respectively). Whereas men continued to be predicted to meet the national recommendations until age 56 (50%), women fell below the threshold at age 37 (49%). Similarly, both males and females with a high school equivalency were predicted to participate at levels that met the national recommendations. Although males remained above the threshold for all levels of education (see Figure 6), females with bachelors (49%), masters (45%), and doctorate degrees (40%) were not projected to meet the national recommendations.

Participants aged 19 to 30 were predicted to meet the national recommendations no matter the level of perceived mobile fitness app support (see Figure 7). However, at age 31 participants were no longer predicted to meet the national recommendations with low levels of mobile fitness app support. By age 44, participants no longer met the threshold with only moderate levels of mobile fitness app support, and the data suggested that participants over the age of 57 were not predicted to meet the national recommendations even with the highest levels of mobile fitness app support.

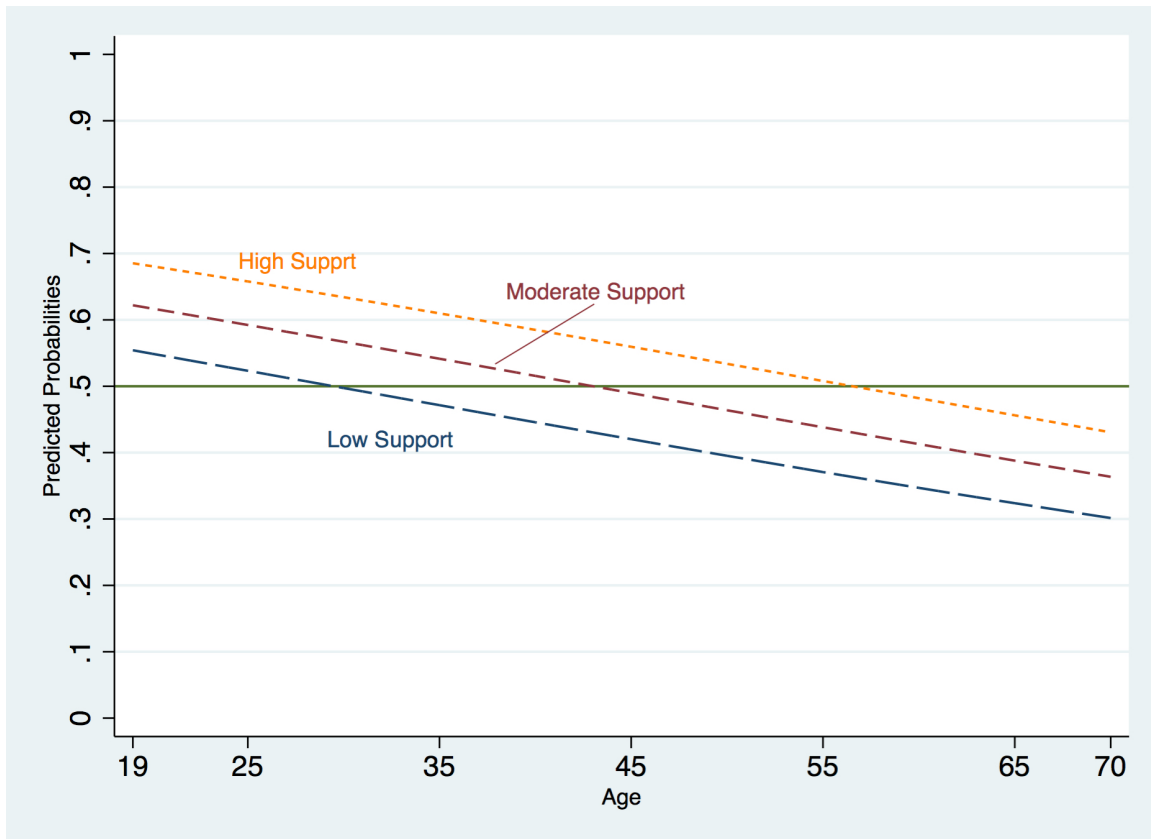


Figure 7. Mobile Fitness App Support: By Age

Across all ages, none of the participants were predicted to participate in physical activity at the nationally recommended levels if they reported having no self-efficacy (see Figure 8). Conversely, all participants with high levels of perceived self-efficacy were predicted to meet the national recommendations. The threshold for being predicted to meet the national recommendations was 60 years old for participants with moderate levels of self-efficacy, and only participants under the age of 28 were predicted to participate at the nationally recommended levels with low levels of perceived self-efficacy.

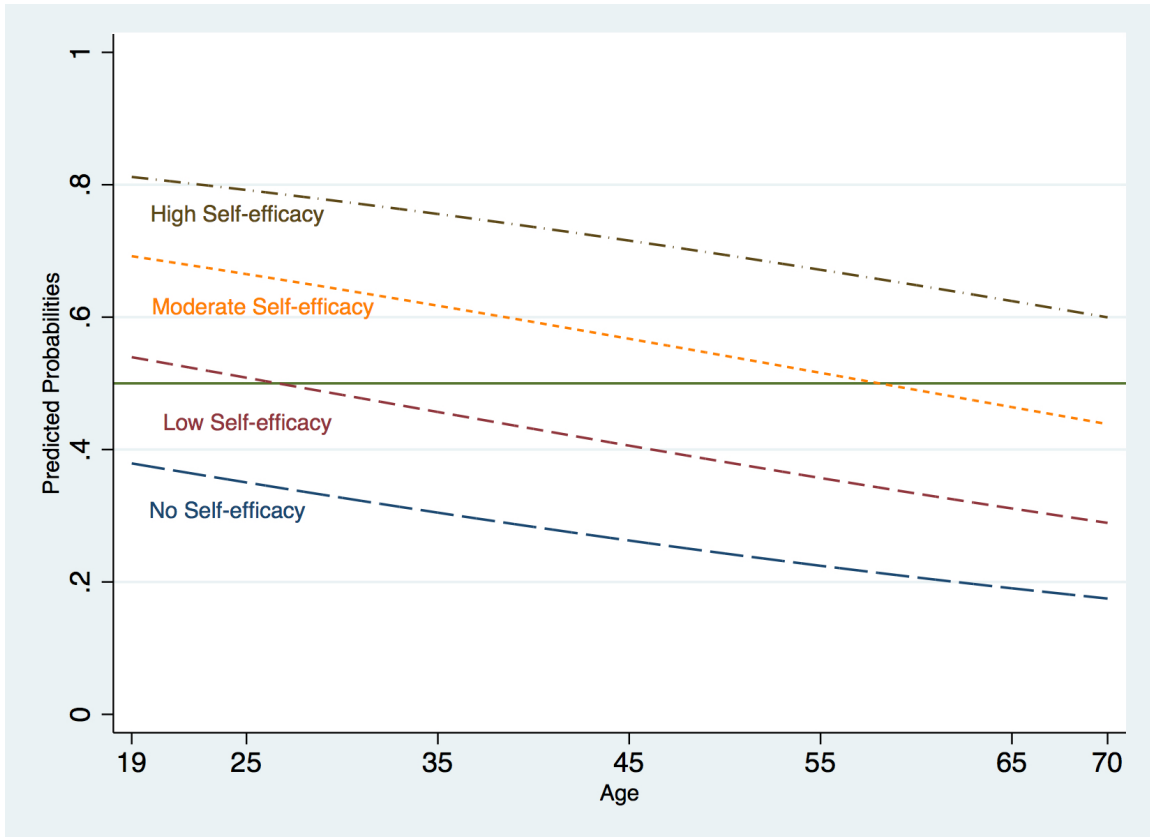


Figure 8. Self-efficacy: By Age

Similar to mobile fitness app support and self-efficacy, none of the participants, regardless of age, were predicted to participate in physical activity at the nationally recommended levels with no perceived peer support (see Figure 9). Nineteen year olds were predicted to meet the national recommendations with the second lowest peer support score (0.33), and by age 26, the participants required a score of “1” or better.

Participants over the age of 40 were not expected to meet the national recommendations with less than a score of “2” on the peer support scale, and participants over the age of 54 were not predicted to do so without at least a score of “3”. Participants over the age of 65 were not predicted to meet the national recommendations with the highest level of peer support.

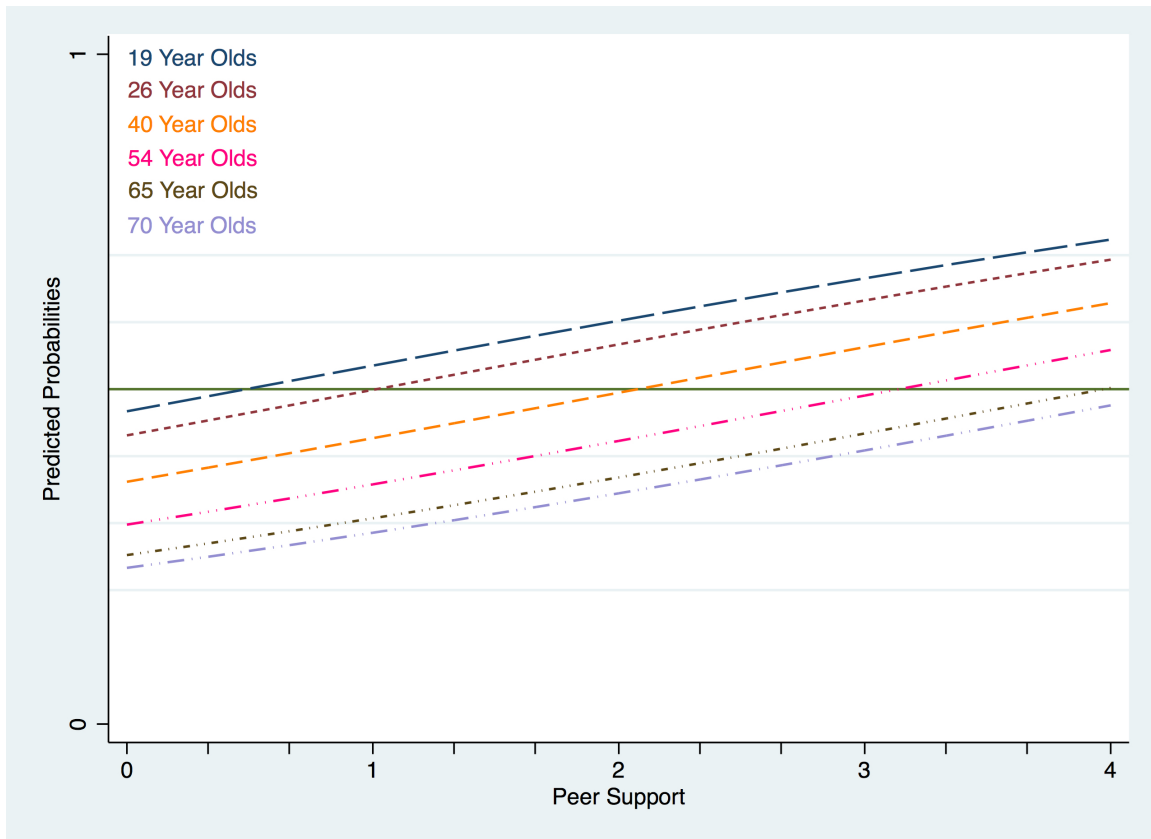


Figure 9. Peer Support: By Age

With respect to a participant's significant other's physical activity behavior, the findings indicated that participants over the age of 21 were not expected to meet the national recommendations for physical activity with no significant other (see Figure 10). Participants who reported having significant others with low levels of physical activity behavior were predicted to meet the national recommendations until age 35. However, with a moderate amount of significant other physical activity behavior, participants did not fall below the threshold until age 49. The results suggested that participants over the age of 63 were not predicted to meet the national recommendations even with the highest level of significant other physical activity behavior.

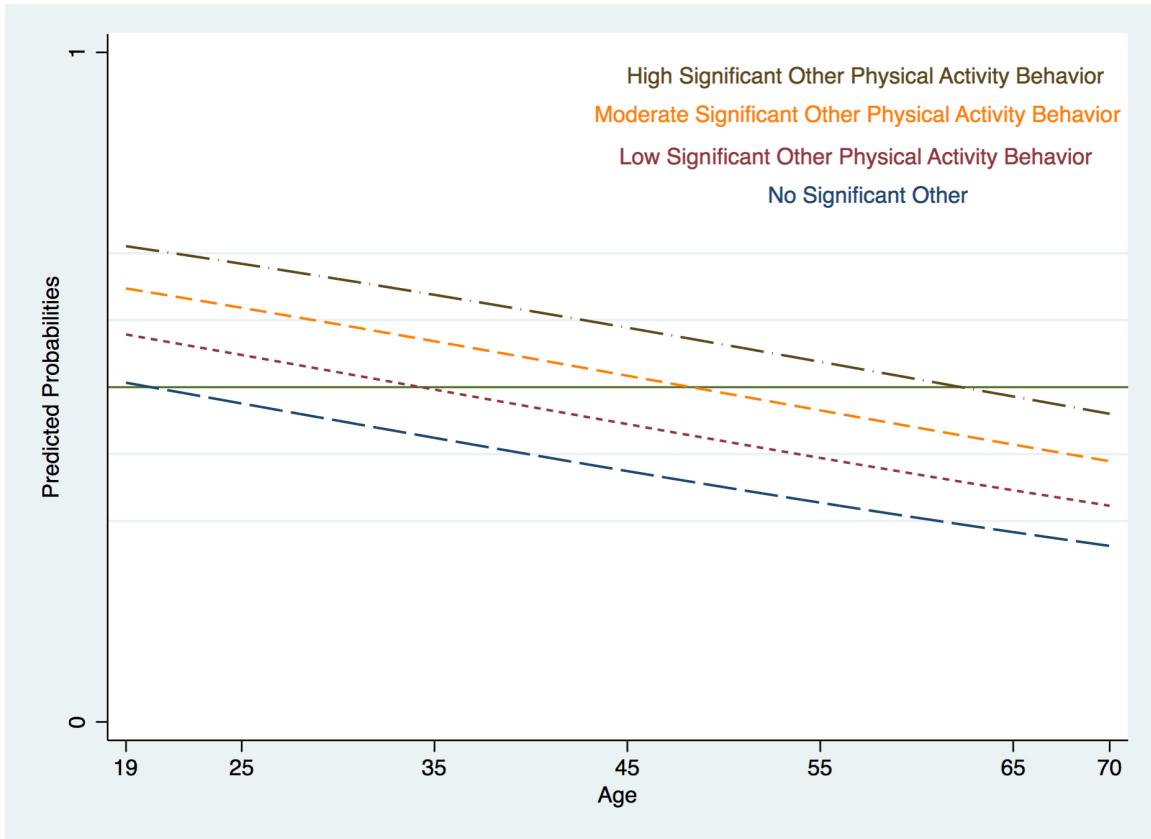


Figure 10. Significant Other's Physical Activity Behavior: By Age

Across all ages, all of the participants were predicted to participate in physical activity at the nationally recommended levels if either a high school equivalency or a technical certificate was their highest level of education (see Figure 11). At the opposite end of the spectrum, participants over the age of 25 were not predicted meet the national recommendations with a doctorate degree. The threshold for being predicted to meet the national recommendations for participants with "some college" was 59 years old, and for participants with an associate's degree, the cutoff was 51 years old. Participants who reported having a bachelor's degree were predicted to meet the national recommendations until age 41. However, with a master's degree, the age reduced to 33.

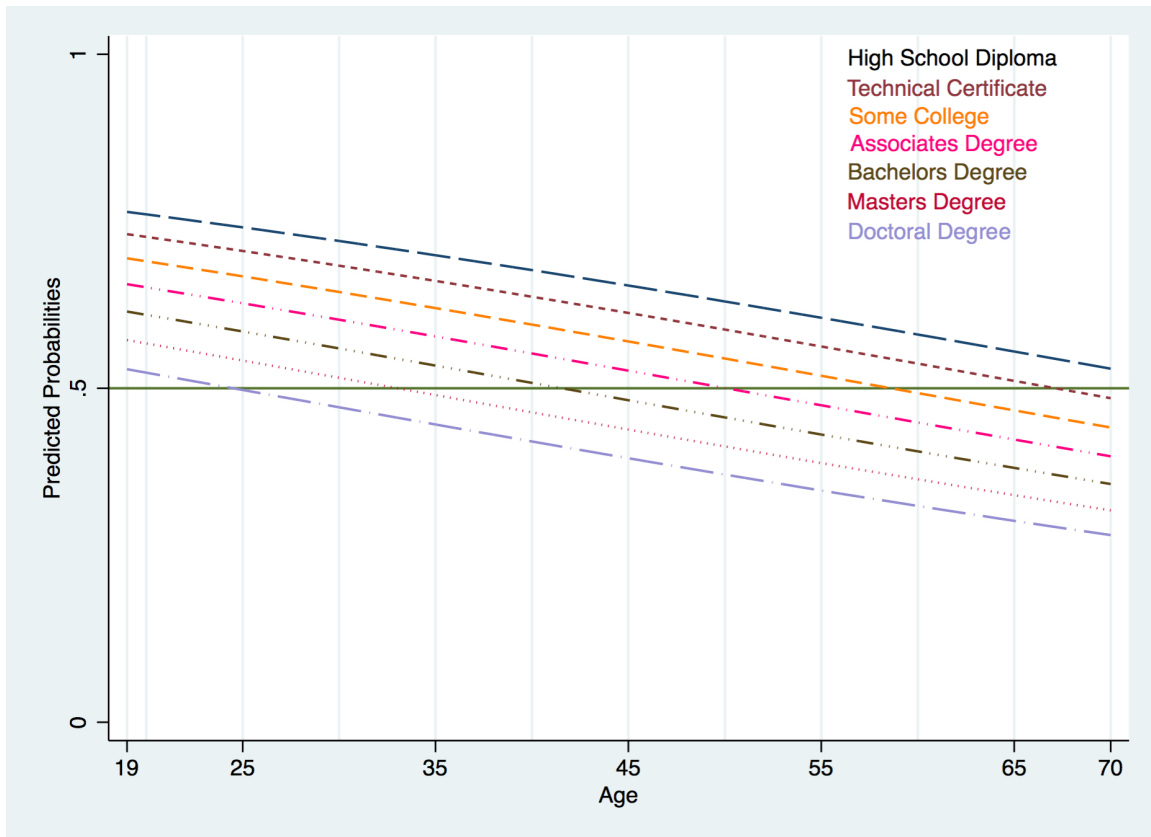


Figure 11. Education: By Age

Multiple Regression Analyses

This section will present the findings of three OLS multiple regressions, which were employed to answer the second, third, and fourth research questions. The purpose was to explore the relationship between social cognitive theory constructs and the three continuous measures of physical activity that comprised the dichotomous dependent variable used in the logistic regression analysis. Similar to the logistic regression analysis, an alpha of 0.05 was used as the threshold for statistical significance.

The three continuous dependent variables were: 1) weekly minutes engaged in physical activity at a vigorous intensity; 2) weekly minutes engaged in physical activity at a moderate intensity; and 3) number of days engaged in strength training. The models (see Figure 12) examined the following independent variables: mobile fitness app support, peer support, family

support, significant other physical activity behavior, and self-efficacy. Education, age, race, and gender were included in the model as control variables.

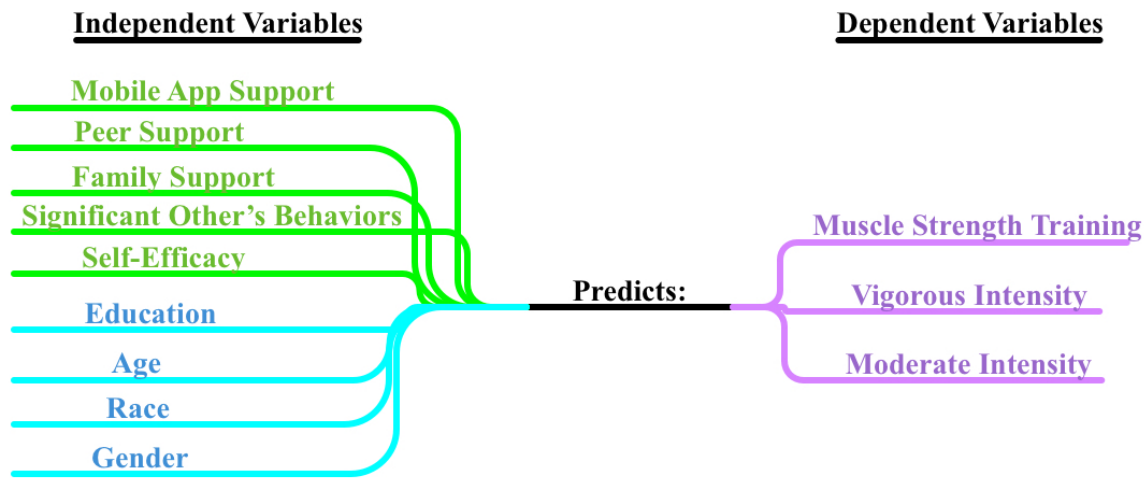


Figure 12. OLS Regression Models

An examination of OLS regression assumptions did not show violations of homoscedasticity or multicollinearity for the moderate ($\chi^2 = 66.68, p > 0.05$; VIF = 1.17) and vigorous intensity models ($\chi^2 = 81.55, p > 0.05$; VIF = 1.17). While the muscle-strengthening model did not show signs of multicollinearity (VIF = 1.17), Cameron and Trivedi's (1990) decomposition information matrix did reveal that it suffered from heteroskedasticity ($\chi^2 = 104.20, p < 0.05$). Therefore, Huber-White estimators were used to correct for the possible violation of the homoscedasticity assumption.

OLS Results: Model One

The moderate activity regression model (Table 12) presented an F statistic of 2.75 and a p value of 0.0013. The F statistic examines the overall fit of the model; therefore, the null hypothesis that the coefficients were equal to zero was rejected in favor of the alternative hypothesis. That is to say that it strains credulity to expect that at least one of the coefficients in the model would not be above zero. Furthermore, the regression model for this study yielded an R^2 of 0.07, which means that the independent variables in the model accounted for

approximately 7% of the explained variance. In addition, the independent variable self-efficacy, as well as one of the control variables (Hispanic participants), yielded significant results at the 0.05 level.

Table 12. OLS Regression Estimates: Moderate Activity

	b	z	β
Self-efficacy***	23.109	2.44	0.12
Peer Support	10.062	1.49	
Family Support	5.994	0.79	
Significant Other's Physical Activity Behavior	0.104	0.01	
Mobile Fitness App Support	11.652	1.11	
Gender	-23.887	-1.45	
Age	0.594	0.72	
Education	1.215	0.21	
Asian*	-75.609	-1.68	
Black	-37.836	-1.04	
Hispanic/Latino**	-87.455	-2.03	-0.10
Multiracial	-32.010	-0.73	
Constant	46.540	1.00	
N	452		
Model F	2.75		
Probability F	0.00		
R ²	0.07		

Note: ***prob < 0.01, **prob < 0.05, *prob < 0.10

With regard to *self-efficacy*, the model produced a significant *t* statistic of 2.44, a *p* value of 0.01, and a *b* coefficient of 23.109. Put differently, when controlling for all other variables, a one-point increase in the self-efficacy variable resulted in a 23.109-unit increase in moderate-intensity physical activity. A similar interpretation can also be used for Hispanic/Latino participants (*b* = -87.455, *t* = -2.03, *p* < 0.05), as a -87.455-unit decrease was observed in moderate-intensity physical activity for participants who self-identified as Hispanic/Latino. The regression analysis also included commands to examine standardized beta coefficients, which can provide information regarding which significant variables had a greater impact on the

moderate-intensity physical activity. Based on the standardized β , impact of the self-efficacy variable (0.12) was greater than that of the variable to control for Asian participants (-0.10).

0.10 significance level. As previously stated, the alpha, or significance level, used in the interpretation of this study was 0.05. While the variable to control for Asian participants did not meet statistical significance at the 0.05 level, it did reach significance at the 0.10 level. The t statistic for Asian participants was -1.68, and the variable produced a p value of 0.094 with a b coefficient of -75.609, which means being Asian resulted in a -75.609-unit decrease in moderate-intensity physical activity.

OLS Results: Model Two

The vigorous intensity regression model (Table 13) presented an F statistic of 7.04 and a p value of 0.0000. The F statistic examined the overall fit of the model; therefore, the null hypothesis that the coefficients were equal to zero was rejected in favor of the alternative hypothesis. Put another way, it is unlikely that at least one of the coefficients in the model would not be above zero. Furthermore, the regression model for this study yielded an R^2 of 0.16, meaning that the independent variables in the model accounted for approximately 16% of the explained variance. In contrast to the moderate intensity regression model, the vigorous intensity model yielded four significant independent variables, and one significant control variable.

Self-efficacy ($b = 28.829, p < .05$), mobile fitness app support ($b = 27.113, p < .05$), peer support ($b = 33.461, p < .05$), and significant other's physical activity behavior ($b = 25.715, p < .05$) comprised the significant independent variables for explaining vigorous-intensity activity. The gender control variable also met the threshold for significance ($b = -30.977, p < .05$). With regard to standardized beta coefficients, the model suggested that peer support ($\beta = 0.23$) had the greatest impact on vigorous-intensity physical activity. Peer support was followed by self-

efficacy ($\beta = 0.127$), significant other's physical activity behavior ($\beta = 0.125$), mobile fitness app support ($\beta = 0.12$), and gender ($\beta = -0.08$).

Table 13. OLS Regression Estimates: Vigorous Activity

	b	z	β
Self-efficacy***	28.829	2.79	0.127
Peer Support***	33.461	4.56	0.23
Family Support	-12.618	-1.53	
Significant Other's Physical Activity Behavior***	25.715	2.42	0.125
Mobile Fitness App Support***	27.113	2.37	0.12
Gender**	-30.977	-1.73	-0.08
Age	-.2416	-0.27	
Education	-6.868	-1.08	
Asian	11.824	0.24	
Black	-42.746	-1.07	
Hispanic/Latino	-36.141	-0.77	
Multiracial	-21.008	-0.44	
Constant	74.975	1.47	
N	452		
Model F	7.04		
Probability F	0.00		
R ²	0.16		

Note: ***prob < 0.01, **prob < 0.05, *prob < 0.10

OLS Results: Model Three

The strength training regression model (Table 14) presented an F statistic of 20.18 and a p value of 0.0000. The null hypothesis that the coefficients were equal to zero was rejected in favor of the alternative hypothesis that the variables explained at least some of the variance for the dependent variable. Furthermore, the regression model yielded an R^2 of 0.28, meaning that the independent variables in the model accounted for approximately 28% of the explained variance.

Self-efficacy ($b = 0.389$, $p < .05$), mobile fitness app support ($b = 0.384$, $p < .05$), peer support ($b = 0.427$, $p < .05$), and significant other's physical activity behavior ($b = 0.237$, $p < .05$).

.05) comprised the significant independent variables for explaining vigorous intensity activity. Four control variables also met significance at the 0.05 level: age ($b = -0.023, p < .05$), gender ($b = -0.667, p < .05$), education ($b = -0.131, p < .05$), and Black/African American participants ($b = 0.863, p < .05$). Standardized beta coefficients suggested that peer support ($\beta = 0.26$) had the greatest impact on vigorous-intensity physical activity. Following peer support was self-efficacy ($\beta = 0.149$), gender ($\beta = -0.148$), mobile fitness app support ($\beta = 0.146$), significant other's physical activity behavior ($\beta = 0.103$), age ($\beta = -0.102$), Black/African American participants ($\beta = 0.09$), and education ($\beta = 0.08$).

Table 14. OLS Regression Estimates: Strength Training

	b	z	β
Self-efficacy***	0.379	3.33	0.148
Peer Support***	0.427	5.43	0.26
Family Support	-0.005	-0.05	
Significant Other's Physical Activity Behavior**	0.237	1.99	0.102
Mobile Fitness App Support***	0.384	3.02	0.146
Gender***	-0.667	-3.54	-0.147
Age***	-0.023	-2.39	-0.101
Education**	-0.131	-1.89	-0.082
Asian	0.238	0.52	
Black**	-0.862	-2.21	-0.085
Hispanic/Latino	0.222	0.41	
Multiracial	0.742	1.33	
Constant	2.161	3.63	
N	452		
Model F	20.18		
Probability F	0.00		
R ²	0.28		

Note: ***prob < 0.01, **prob < 0.05, *prob < 0.10

Research Questions and Associated Hypotheses

The following section will apply the analyses described in the previous sections to the examination of the four research questions that guided the study. Five hypotheses were

associated with each research question. For each research question, the first hypothesis statement indicated that social cognitive constructs would have had a relationship with the corresponding dependent variable. The remaining four hypothesis statements for each research question examined the social cognitive constructs individually. Accordingly, the first hypothesis statement associated with each research question was accepted or rejected based on the remaining hypothesis statements. For this reason, the first hypothesis statement has been examined last for each research question.

National Recommendations

The first research question was “Do social cognitive theory constructs predict adult physical activity at the nationally recommended levels for substantive health benefits?” The coefficients from the logistic regression were interpreted in order to examine the five corresponding hypotheses (see Table 15).

Table 15. Hypothesis Statements for Research Question One

Do social cognitive theory constructs predict adult physical activity at the nationally recommended levels for substantive health benefits?

- H₁ Social cognitive theory constructs predict adult physical activity at the nationally recommended levels for substantive health benefits.
 - H₂ Peer support predicts adult physical activity at the nationally recommended levels for substantive health benefits.
 - H₃ Familial support predicts adult physical activity at the nationally recommended levels for substantive health benefits.
 - H₄ Self-efficacy predicts adult physical activity at the nationally recommended levels for substantive health benefits.
 - H₅ Mobile fitness app support predicts adult physical activity at the nationally recommended levels for substantive health benefits.
-

Hypothesis two. The second hypothesis statement specified that peer support would predict adult physical activity at the nationally recommended levels for substantive health benefits. The peer support variable ($b = 0.273, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that peer support does not predict adult physical activity at the nationally recommended levels for substantive health benefits. Based on the results in this study, peer support does predict adult physical activity at the nationally recommended levels for substantive health benefits.

Hypothesis three. The third hypothesis statement specified that familial support would predict adult physical activity at the nationally recommended levels for substantive health benefits. The significant other's physical activity behavior variable ($b = 0.290, p < .05$) was statistically significant at the 0.05 level; however, the family support variable ($b = 0.110, p > .05$) did not. Therefore, the results of this study provide partial support for the hypothesis. The hypothesis was supported that family support predicts adult physical activity at the nationally recommended levels for substantive health benefits, but only as it relates to a significant other's physical activity behavior. That is to say, the results do not support the hypothesis that family support, as operationalized by the family support scale, predicts adult physical activity at the nationally recommended levels.

Hypothesis four. The fourth hypothesis statement stated that self-efficacy would predict adult physical activity at the nationally recommended levels for substantive health benefits. The self-efficacy variable ($b = 0.652, p < .05$) was statistically significant at the 0.05 level. The results are in favor of rejecting the null hypothesis that self-efficacy does not predict adult physical activity at the nationally recommended levels for substantive health benefits. Therefore,

based on the results in this study, self-efficacy does predict adult physical activity at the nationally recommended levels for substantive health benefits.

Hypothesis five. The fifth hypothesis statement specified that mobile fitness app support would predict adult physical activity at the nationally recommended levels for substantive health benefits. The mobile fitness app support variable ($b = 0.280, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that mobile fitness app support does not predict adult physical activity at the nationally recommended levels for substantive health benefits. Based on the results in this study, mobile fitness app support does predict adult physical activity at the nationally recommended levels for substantive health benefits.

Hypothesis one. The first hypothesis statement specified that social cognitive constructs would predict adult physical activity at the nationally recommended levels for substantive health benefit. The results of this study provided evidence to suggest that peer support, significant other's physical activity behaviors, self-efficacy, and mobile fitness app support systems were predictors of physical activity at the nationally recommended levels for substantive health benefit. Therefore, the results were in favor of rejecting the null hypothesis that social cognitive constructs do not predict adult physical activity at the nationally recommended levels for substantive health benefits.

Moderate Intensity

The second research question was "Do social cognitive theory constructs increase adult physical activity at moderate levels of intensity?" The first OLS regression model was used to investigate four hypotheses associated with the second research question (see Table 16).

Table 16. Hypothesis Statements for Research Question Two

Do social cognitive theory constructs increase adult physical activity at moderate levels of intensity?

- H₁ Social cognitive theory constructs increase adult physical activity at moderate levels of intensity.
 - H₂ Peer support increases adult physical activity at moderate levels of intensity.
 - H₃ Familial support increases adult physical activity at moderate levels of intensity.
 - H₄ Self-efficacy increases adult physical activity at moderate levels of intensity.
 - H₅ Mobile fitness app support increases adult physical activity at moderate levels of intensity.
-

Hypothesis two. The second hypothesis statement stated that peer support would increase adult physical activity at moderate levels of intensity. The results of this study do not support the hypothesis because peer support ($b = 10.06, p > .05$) did not reach statistical significance at the .05 level. Therefore, based on the results in this study, peer support does not increase adult physical activity at moderate levels of intensity.

Hypothesis three. The third hypothesis statement stated that familial support would increase adult physical activity at moderate levels of intensity. The results did not support the hypothesis because neither of the familial support variables (family support: $b = 5.99, p > .05$; significant other's physical activity behavior: $b = 0.104, p > .05$) met the threshold for statistical significance at the .05 level. Therefore, based on the results in this study, family support does not increase adult physical activity at moderate levels of intensity.

Hypothesis four. The fourth hypothesis statement stated that self-efficacy would increase adult physical activity at moderate levels of intensity. The self-efficacy variable ($b = 23.109, p < .05$) was statistically significant at the 0.05 level. The results are in favor of rejecting the null hypothesis that self-efficacy does not increase adult physical activity at moderate levels

of intensity. Therefore, based on the results in this study, self-efficacy does increase adult physical activity at moderate levels of intensity. Furthermore, the standardized beta coefficients suggested that self-efficacy (0.12) had the greatest impact on adult physical activity at moderate levels of intensity.

Hypothesis five. The fifth hypothesis statement stated that mobile fitness app support would increase adult physical activity at moderate levels of intensity. The results of this study do not support the hypothesis because mobile fitness app support ($b = 11.65, p > .05$) did not reach statistical significance at the .05 level. Therefore, based on the results in this study, mobile fitness app support does not increase adult physical activity at moderate levels of intensity.

Hypothesis one. The first hypothesis statement specified that social cognitive constructs would increase adult physical activity at moderate levels of intensity. The results provided evidence to suggest that social cognitive constructs did increase adult physical activity at moderate levels of intensity. However, significance was established for only one social cognitive construct: self-efficacy. Nonetheless, the null hypothesis was rejected in favor of the alternative hypothesis.

Vigorous Intensity

The third research question was “Do social cognitive theory constructs increase adult physical activity at vigorous levels of intensity?” The second OLS regression model was used to investigate the four hypotheses associated with the third research question (see Table 17).

Table 17. Hypothesis Statements for Research Question Three

Do social cognitive theory constructs increase adult physical activity at vigorous levels of intensity?

H₁ Social cognitive theory constructs will increase adult physical activity at vigorous levels of intensity.

(Table 17 continued)

- H₂ Peer support increases adult physical activity at vigorous levels of intensity.
 - H₃ Familial support increases adult physical activity at vigorous levels of intensity.
 - H₄ Self-efficacy increases adult physical activity at vigorous levels of intensity.
 - H₅ Mobile fitness app support increases adult physical activity at vigorous levels of intensity.
-

Hypothesis two. The second hypothesis statement stated that peer support would increase adult physical activity at vigorous levels of intensity. The peer support variable ($b = 33.460, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that peer support does not increase adult physical activity at vigorous levels of intensity. Based on the results in this study, peer support does increase adult physical activity at vigorous levels of intensity. Furthermore, the standardized beta coefficients suggested that peer support (0.23) had the greatest impact on adult physical activity at vigorous levels of intensity.

Hypothesis three. The third hypothesis statement stated that familial support would increase adult physical activity at vigorous levels of intensity. The results did not support the hypothesis because neither of the familial support variables (family support: $b = 1.53, p > .05$; significant other's physical activity behavior: $b = 25.715, p > .05$) met the threshold for statistical significance at the .05 level. Therefore, based on the results in this study, family support does not increase adult physical activity at vigorous levels of intensity.

Hypothesis four. The fourth hypothesis statement stated that self-efficacy would increase adult physical activity at vigorous levels of intensity. The self-efficacy variable ($b = 28.829, p < .05$) was statistically significant at the 0.05 level. The results are in favor of rejecting the null hypothesis that self-efficacy does not increase adult physical activity at vigorous levels

of intensity. Therefore, based on the results in this study, self-efficacy does increase adult physical activity at vigorous levels of intensity.

Hypothesis five. The fifth hypothesis statement stated that mobile fitness app support would increase adult physical activity at vigorous levels of intensity. The mobile fitness app support variable ($b = 27.113, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that mobile fitness app support does not increase adult physical activity at vigorous levels of intensity. Based on the results in this study, mobile fitness app support does increase adult physical activity at vigorous levels of intensity.

Hypothesis one. The first hypothesis statement specified that social cognitive constructs would increase adult physical activity at vigorous levels of intensity. The results indicated that peer support, significant other's physical activity behaviors, self-efficacy, and mobile fitness app support systems increased adult physical activity at moderate levels of intensity. Therefore, the results were in favor of rejecting the null hypothesis that social cognitive constructs do not increase adult physical activity at vigorous levels of intensity.

Strength Training

The fourth research question was "Do social cognitive theory constructs increase the number of days spent engaged in muscle strength training?" The third OLS regression was used to investigate the four hypotheses associated with the fourth research question (see Table 18).

Table 18. Hypothesis Statements for Research Question Four

Do social cognitive theory constructs increase the number of days spent engaged in muscle strength training?

- H₁ Social cognitive theory constructs increase the number of days spent engaged in muscle strength training.
- H₂ Peer support increases the number of days spent engaged in muscle strength training.

(Table 18 continued)

- H₃ Familial support increases the number of days spent engaged in muscle strength training.
 - H₄ Self-efficacy increases the number of days spent engaged in muscle strength training.
 - H₅ Mobile fitness app support increases the number of days spent engaged in muscle strength training.
-

Hypothesis two. The second hypothesis statement stated that peer support would increase the number of days spent engaged in muscle strength training. The peer support variable ($b = 0.427, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that peer support does not increase the number of days spent engaged in muscle strength training. Based on the results in this study, peer support does increase the number of days spent engaged in muscle strength training. Furthermore, the standardized beta coefficients suggested that peer support (0.26) had the greatest impact on the number of days spent engaged in muscle strength training.

Hypothesis three. The third hypothesis statement stated that familial support would increase the number of days spent engaged in muscle strength training. The significant other physical activity behavior variable ($b = 0.237, p < .05$) was statistically significant at the 0.05 level; however, the family support variable ($b = -0.005, p > .05$) did not. Therefore, the results of this study provide partial support for the hypothesis. The hypothesis was supported in that family support predicts the number of days spent engaged in muscle strength training, but only as it relates to a significant other's physical activity behavior. That is to say, the results do not support the hypothesis that family support, as operationalized by the family support scale, predicts the number of days spent engaged in muscle strength training.

Hypothesis four. The fourth hypothesis statement stated that self-efficacy would increase the number of days spent engaged in muscle strength training. The self-efficacy variable ($b = 0.379, p < .05$) was statistically significant at the 0.05 level. The results are in favor of rejecting the null hypothesis that self-efficacy does not increase the number of days spent engaged in muscle strength training. Therefore, based on the results in this study, self-efficacy does increase the number of days spent engaged in muscle strength training.

Hypothesis five. The fifth hypothesis statement stated that mobile fitness app support would increase the number of days spent engaged in muscle strength training. The mobile fitness app support variable ($b = 0.384, p < .05$) was statistically significant at the 0.05 level. Thus, the results are in favor of rejecting the null hypothesis that mobile fitness app support does not increase the number of days spent engaged in muscle strength training. Based on the results in this study, mobile fitness app support does increase the number of days spent engaged in muscle strength training.

Hypothesis one. The first hypothesis statement specified that social cognitive constructs would increase the number of days spent engaged in muscle strength training. The results indicated that peer support, significant other's physical activity behaviors, self-efficacy, and mobile fitness app support systems increased the number of days spent engaged in muscle strength training. Therefore, the results were in favor of rejecting the null hypothesis that social cognitive constructs do not increase the number of days spent engaged in muscle strength training.

CHAPTER 5: DISCUSSION AND CONCLUSION

This study sought to test the predictability of social cognitive theory constructs on physical activity at the nationally recommended levels for substantive health benefit. In addition to the national recommendations, this study also examined the relationship between social cognitive constructs and the three physical activity measures used to determine adherence to the national recommendations: physical activity at moderate levels of intensity; physical activity at vigorous levels of intensity; and the number of days engaged in muscle strength training. The unique contribution of this study is the inclusion of mobile fitness app support as an environmental factor within social cognitive theory. Given that advances in mobile technology have allowed people to connect with others to obtain, and provide, support for physical activity, there was a need to examine the effectiveness of this new form of support.

Physical Activity: National Recommendations

The four research questions corresponded to four operationalizations of physical activity. The first research question (see Table 15) utilized a logistic regression to predict physical activity at levels that met the current national standards for substantive health benefit. The analysis fully supported three of the four hypotheses; indeed, the model suggested that self-efficacy, peer support, and mobile fitness app support each predicted physical activity at the national recommendations for substantive health benefit. Furthermore, standardized estimates indicated that self-efficacy was the most powerful predictor, which is consistent with previous research (Bean et al., 2012; Dewar et al., 2013; Rogers et al., 2007; Tavares et al., 2009), as self-efficacy is often regarded as the most influential predictor of physical activity.

Partial support was established for the predictability of family support. Put differently, family support was found to be significant, but only in relation to the physical activity behaviors

of a participant's significant other. Support for this finding can be found in previous research, as Berge and colleagues (2012) provided evidence to suggest that study participants were more likely to participate if their spouses exhibited healthy physical activity behaviors. Although recent studies have presented mixed results regarding whether companionship or emotional support is most predictive of physical activity participation, it seems as though both have the potential to be highly influential types of social support (Kouvonen et al., 2012; Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2006). These findings may be particularly true in terms of spousal support; indeed, couples who work out, specifically those who do so together, tend to lead healthier lives, engage in physical activity at higher rates, and have higher levels of exercise self-efficacy (Ayotte et al., 2013; Hong et al., 2005).

Three of the control variables (gender, age, education) were also found to be significant. For gender, females were 10% less likely than males to participate in physical activity at levels congruent with the national recommendations. This finding is not uncommon, as previous research has concluded that males are oftentimes more likely to be active than females (Dzewaltowski et al., 2008; Kirby et al., 2011; Martin et al., 2011; Patnode et al., 2010; Raudsepp, 2006; Woods et al., 2012). The post-estimation predicted probabilities also provided deeper insight into how gender may moderate physical activity behavior. For instance, men were predicted to surpass the national recommended levels regardless of mobile fitness app support levels (see Figure 6). However, females were not predicted to participate at the recommended levels without at least moderate levels of support from mobile fitness apps. With regard to self-efficacy (see Figure 6), both males and females were not predicted to meet the national recommendations with no perceived self-efficacy. Figure 6 also shows that despite remaining positive, the rate of increase for males was slightly slower than for females from moderate to

high levels of self-efficacy. However, males exceeded the threshold with only low levels, while females required moderate levels before being predicted to meet the national recommendations. In a similar way, males only needed low levels of peer support (see Figure 6) or significant other's physical activity (see Figure 6) to be projected to meet the national standards, whereas, female predictions gravitated toward the moderate to high levels before being predicted to meet the national recommendations.

The analysis in this study suggested that younger participants were more likely to participate than older participants, which remained true across all predicted probability estimations. Indeed, despite the predictive power of the social cognitive constructs, a steady rate of decline was predicted for all participants as they age. The analysis did reveal that all ages of participants would be predicted to participate at nationally recommended levels if they had high perceptions of self-efficacy (see Figure 8); however, none of the participants were predicted to do so with no perceived self-efficacy.

Although not as powerful a predictor as self-efficacy, higher levels of support did prolong older participants from falling below the threshold for being predicted to meet the national recommendations. For example, with high levels of perceived support via a mobile fitness app, participants were predicted to meet the national recommendations until age 57 (see Figure 7), compared to 31 years old for participants with low perceptions of mobile fitness app support. Likewise, with high perceptions of peer support, participants were predicted to meet the national recommendations until age 65 (see Figure 9). In contrast, the results did not predict that any of the participants would meet the national recommendations with no perceived peer support.

The logit model indicated that education was also significant in predicting physical activity at nationally recommended levels, but the results were not in the expected direction. For

participants in the current study, the more education a person had received, the less likely they were to be predicted to participate at the nationally recommended levels. In fact, the predicted probability decreased 25% from high school to a doctorate level of education. An additional step was taken to compare the predicted probabilities to the observed values (see Figure 13), which revealed that the model was fairly accurate; indeed, the model only generated 24 mispredictions based solely on education level.

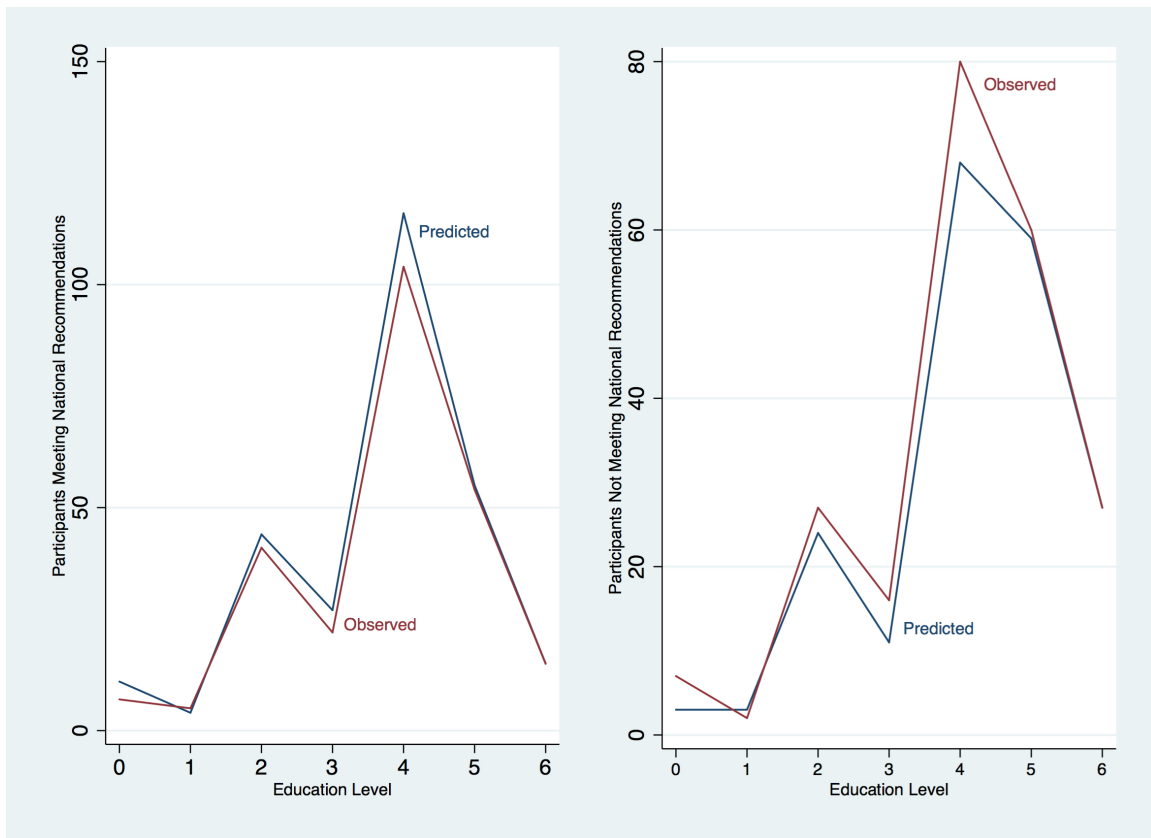


Figure 13. Observed vs. Predicted Values: By Education

The model indicated that higher education was more detrimental for women than men. Men were predicted to meet the national recommendations across all levels of education (see Figure 6), whereas women with a bachelors degree and higher were not. The model also specified that all ages of participants with a high school equivalency or a technical certificate were predicted to meet the national recommendations, but a declining trend was detected for all

ages as they gained higher levels of education, with doctoral level participants not being predicted to meet the national recommendations over the age of 25.

Given that the shortest path to a doctorate is likely to graduate from high school (at age 17 or 18), obtain a bachelors degree (by age 21 or 22), and then complete a doctorate (by age 25 or 26), conventional wisdom would suggest that most of the participants with a doctorate were over the age of 25. Indeed, an examination of the data revealed that 42 of the participants reported having obtained a doctorate; of those 42, all but one was over the age of 25. A more detailed investigation revealed that the model correctly predicted the one participant under the age of 25 with a doctorate, as well as 65% ($n = 27$) of cases for those participants over the age of 25 with a doctorate. That is to say that 35% ($n = 14$) of participants over the age of 25 with a doctorate were mispredicted, and seven were incorrectly predicted to not meet the national recommendations. Hence, the predictions from the model did not drastically misrepresent the physical activity behaviors of participants with a doctorate. As it were, participants with a doctorate degree were less likely to participate in physical activity than participants with lower levels of education.

Physical Activity: Continuous Measures

A dichotomous dependent variable was used in the analysis for the first research question to investigate adherence to the national physical activity standards. However, existing literature has challenged the use of dichotomous dependent variables because they lack depth and understanding (Allison, Gorman, & Primavera, 1993). For example, the national recommendations suggest that adults participate in at least 150 weekly minutes of physical activity at a moderate intensity (HHS, 2008). Therefore, the cutoff for being categorized as meeting the national recommendations was 150 minutes, but some scholars may argue that a

person who participates in 150 weekly minutes (30 minutes a day, five days a week) is more likely comparable to a person who participates in 120 weekly minutes (30 minutes a day, four days a week) than with a person who participates in 300 weekly minutes (60 minutes a day, five days a week). Yet, in the current study, the person who participated in 120 minutes would have been categorized as having a different outcome than the person who participated in 150 minutes. For this reason, OLS regressions were employed for the remaining three research questions (refer to Tables 16, 17, and 18), which investigated the three continuous variables used to construct the dichotomous dependent variable from the first research question.

The only independent variable that remained significant across all regression models was self-efficacy (refer to Tables 11, 12, 13, and 14), but evidence was found to support the hypotheses that mobile fitness app support, peer support, and significant other's physical activity behavior were positively and significantly associated with vigorous activity and muscle strength training. These results suggest that while self-efficacy was required for any amount of physical activity, some form of social support may have been needed for more strenuous activities. Furthermore, the standardized beta coefficients revealed that peer support was the most influential variable for increased levels of muscle strength training ($\beta = 0.26$) and vigorous intensity activity ($\beta = 0.23$).

The linear regression models yielded a diverse array of control variable coefficients, as none of the control variables were significant in all three models. In fact, gender was the only control variable to reach significance in multiple models. Gender was found to have a significant negative relationship with vigorous activity and muscle strength training. That is to say, females were less likely than males to participate in increased muscle strength training and less likely to participate in higher levels of vigorous activity. With regard to muscle strength training, the

analysis also revealed a negatively association with Black/African American participants. In a similar way, Latino participants were adversely related to participating at moderate intensities. These findings are consistent with existing literature suggesting that minorities may be less influenced by social cognitive constructs and participate at lower levels of physical activity (Dishman et al., 2002; Dishman et al., 2009; Gao, 2012; Harmon et al., 2014; Trost et al., 1997).

Moderate and vigorous activity levels were independent of age and education, but both were found to be significant, and negative, predictors of muscle strength training. Consistent with a nationally representative CDC survey, older participants who took the Behavioral Risk Factor Surveillance System (CDC, 2013) also participated in muscle strength training at less frequent rates than younger adults. However, BRFSS participants with higher levels of education levels were more likely to engage in muscle strength training. One explanation for the discrepancy could be that the current study differentiated between associates, bachelors, masters, and doctoral degrees, whereas the aforementioned degrees were collapsed into one category in the BRFSS. Given the findings, future research should continue to explore how higher education impacts muscle strength training.

Implications for Social Work

The findings of this study have a number of implications for the field of social work. In particular, policy implications include advocating for funds to be made available for programs to assist women, who were 10% less likely than men to meet the national recommendations for substantive health benefit. The findings have also provided information to assist researchers and practitioners with specific programmatic objectives that may help increase the number of women who meet the national recommendations. For example, in the current study, women over the age of 35 were no longer predicted to meet the national recommendations. However, the analysis

also indicated that women were expected to meet the national recommendations with moderate levels of peer support. Therefore, social workers may be able to develop programs focused on enhancing existing, or cultivating new, peer support networks for women over the age of 35. Women were also predicted to meet the national recommendations with moderate levels of mobile fitness app support. Interventions can be developed wherein mobile fitness apps are offered to women to encourage the use of mobile fitness app support systems, which will also help researchers learn more about this new technology. With an expanded knowledgebase, social workers can then work with app developers to refine mobile support networks to enhance the user's experience and, hopefully, increase adherence to the national physical activity recommendations.

The significant other's physical activity behavior variable was a composite of how often the significant other worked out and how often the significant other worked out with the participant. Although the findings suggested that men were not as influenced by their partner's physical activity behavior as women, the model did indicate that women were more likely to meet the national recommendations if their partners had higher levels of physical activity behavior. Hence, family-based programs may be an effective way for social workers to assist women in meeting the national recommendations.

Independent of gender, the current study also revealed that self-efficacy played an important role in physical activity across the lifespan, as indicated by the predicted probabilities suggesting self-efficacy became more crucial as a person aged. This finding is consistent with previous research, which has supported higher levels of self-efficacy as a mechanism for increased physical activity participation, particularly in older adults (Cousins & Tan, 2002; E. Smith, Anderson, Winett, Wojcik, & Williams, 2011). Therefore, researchers and practitioners

are advised to incorporate techniques to enhance self-efficacy in all activity-based programs, regardless of the age of the target population.

In addition to field experience, one technique used by social work programs to enhance counseling skills is to have students watching videos or listening to audio recordings of themselves and their peers. (Iverson, 1986). These same techniques may also be used to increase self-efficacy for their clients. Indeed, women may obtain enhanced levels of self-efficacy for physical activity by watching or listening to a woman with a similar backstory. For example, many people perceive time as a barrier to physical activity (see Dishman & Sallis, 1994; Rimmer et al., 2010). A single working mother may not perceive enough time in the day to participate in 30 minutes of moderate-intensity exercise and attend to all her other responsibilities. However, she may increase her belief in her ability to be successful after listening to the techniques currently being used by other single working mothers with children. Therefore, programs that target women may see enhanced outcomes if opportunities are included for women to learn vicariously.

Consistent with previous research (Bean et al., 2012; Dewar et al., 2013; Rogers et al., 2007; Tavares et al., 2009), the findings of the current study also revealed that self-efficacy was the most influential predictor of physical activity. However, females required higher levels of self-efficacy than their male counterparts. Bandura (1989) hypothesized that self-efficacy was influenced by four factors: vicarious experiences, verbal persuasion, physiological states, and past performances. Many of the skills acquired in social work programs will provide social workers with the tools necessary to support increases in self-efficacy. For example, Miller and Rolnick's (1991) Motivational Interviewing (MI) approach to behavior change may lay the groundwork for social workers to enhance self-efficacy via verbal persuasion and past

performances. MI techniques include affirmations and feedback, both of which are a form of verbal persuasion. While feedback is already highly utilized in physical activity research (Gilson & Feltz, 2012; Senécal et al., 2008), affirmations involve using a client's own words or behaviors to highlight strengths and successes (Tooley & Moyers, 2012), such as "Wow, you're getting faster every day; Last week you ran a mile in 15 minutes, and this week you did it in 14 minutes and 25 seconds!"

MI training also includes techniques for reframing past events (Hohman, 2012), which may be helpful in encouraging discouraged clients to view unsuccessful past performances with a positive perspective. Bandura (1977) hypothesized that not all unsuccessful performances will lead to decreases in self-efficacy. If a person learns how to reframe an unsuccessful experience, self-efficacy may indeed be enhanced. For example, a woman may be discouraged because she did not participate in 150 minutes of physical activity in the previous week, but this experience may be positively reframed if she looks at her behavior over the past four weeks and comes to the realization that she is getting closer to meeting the national recommendations every week.

In addition to self-efficacy, researchers, practitioners, and policy makers are recommended to include some form of social support system into future programs. Although all significant support systems were found to be influential for younger populations, the required amounts of support tended to increase as a person aged. Older participants in the current sample were most influenced by peer support. Therefore, older populations may benefit from programs that include other like-minded individuals, such as a walking club (see Hanson & Jones, 2015).

Despite the fact that the results of this study do not show causation, the findings do reveal that mobile fitness app support is a significant predictor of physical activity. Researchers should build upon these findings and examine the extent to which mobile support may be used in the

field of social work. For example, researchers at Stanford University are currently piloting a text message-based program for parents (York & Loeb, 2014). The objective of the program is to examine the effect of parenting tips (informational support) provided via text message on school readiness. While studies have supported the use of text messaging as a support system (see Toscos et al., 2008), an app may be more useful in certain situations, such as programs servicing low-income populations. For example, program staff at a Baton Rouge, Louisiana after-school program that services predominantly Black/African American low income families has recently indicated that it is hard to reach parents due to the frequency with which their phone numbers are inactive (M. Washington, personal communication, March 16, 2016). This personal experience is consistent with findings suggesting that low-income families, especially those with less than a \$30,000 household income, are more likely to incur finance-related service interruptions (Pew Research Center, 2015). Research has also shown that 42% of low-income Black/African Americans have experienced finance-related service interruptions compared to 17% of low-income White/Caucasians (Pew Research Center, 2015). Thus, low income Black/African American families may be in need of support services that do not rely on mobile service plans.

Text message-based communication relies on a service plan, whereas, app-based communication may utilize a data plan or an existing wifi network. Even if financial hardships cause wifi service interruptions at home, an app can still be used at a public wifi hotspot. ABI Research (2015) has revealed that \$5.69 million of public wifi hotspots existed worldwide in 2014, with that number expected to grow at least 10% by 2020. Many apps can also be used on a tablet or personal computer in the event that a smartphone is lost, stolen, broken, or has a drained battery, a feature not available to text messaging for all devices. Thus, future researchers should

explore the utilization of app-based mobile support as a mechanism of engagement for social service programs, specifically those servicing low-income populations.

Limitations

The results of the current study, while having set a foundation for exploring mobile fitness apps in relation to physical activity behavior, are not without limitations. This section provides a discussion of the limitations of the study. Included in the discussion are limitations related to the sample, social desirability bias, instrumentation, and data conversion.

Sample

The 2010 Census data (Humes, Jones, & Ramirez, 2011) indicated the following racial/ethnic makeup for the United States: Hispanic/Latino: 16.3%; Whites/Caucasians: 72.4%; Blacks/African Americans: 12.6%; American Indian/Alaska Native: 0.9%; Asian/Pacific Islander: 5%; Multiracial: 2.9%; and Other: 6.2%. The racial/ethnic makeup of the current study was as follows: Hispanic/Latino: 3.64%; Whites/Caucasians: 85.22%; Blacks/African Americans: 4.71%; American Indian/Alaska Native: 0%; Asian/Pacific Islander: 3.21%; Multiracial: 3.21%; and Other: 0%. A Chi-squared goodness of fit test was used to explore differences between the current sample and race/ethnicity data in the most current census. The test indicated that the current study did not include a nationally representative sample of participants based on racial and ethnic background ($\chi^2 = 53.54$; $p < .05$), which limits the generalizability of the findings. Thus, future researchers should replicate the study with a sample that is more representative of the United States population.

The sample was largely composed of White/Caucasian ($n = 398$, 85.22%) participants, which has limited the researcher from making strong predictions regarding minority groups. The Pew Research Center has recently indicated that there is no difference among racial/ethnic

groups in smartphone usage (Perrin, 2015); however, it remains to be seen if minorities are less likely to utilize mobile fitness apps or if the current sampling method did not garner enough minorities to show their utilization of such technology. Thus, future research should incorporate higher numbers of minority groups.

Another minority group that needs to be further examined is the Lesbian, gay, bisexual, transgender, queer or questioning, and intersex (LGBTQI) community. The one respondent who self-identified as gender non-conforming was not included in the final dataset because the response rate was so small, and the analysis did not include any additional variables to examine members of the LGBTQI community. Both Eng (2007) and Toomey and Russell (2013) have previously indicated that the LGBTQI community has been under-researched in sport and physical activity studies. Thus, future researchers should include measures to investigate the usability of mobile fitness app support with this largely overlooked population.

Social Desirability Bias

Another limitation of this study is social desirability bias, which is a limitation for many subjective forms of measurement (Dishman et al., 2001; Sirard & Pate, 2001). Social desirability bias means that some participants may provide answers based on what they think the researcher wants (Crowne & Marlowe, 1960; Rubin & Babbie, 2013). For example, the consent form indicated that social support systems would be assessed; therefore, some participants may have presumed that the researcher was trying to show that social support systems affect physical activity behavior and responded accordingly.

Self-efficacy Scale

Although the sample size was large enough for the number of variables in the model, 179 observations had to be removed from the analysis. One hundred ($n = 100$) participants stopped

completing the survey at the same place, the self-efficacy scale; thus, the self-efficacy scale may have been the cause for the largest portion of removed observations. The only known difference between the self-efficacy scale and the preceding questions was that participants were asked to physically type in a number between 1 – 100 for the self-efficacy scale, whereas participants were provided a Likert scale with radio style buttons for earlier questions.

The survey was largely disseminated via social media. Recent findings have indicated that 60% of people use cell phones to access the Internet, and 34% of people primarily access the Internet from their cell phones (M. Anderson, 2015). Given that the participants had to click in a box and type in their response for each of the 18 self-efficacy questions, it is possible is that the self-efficacy scale was too inconvenient for many of the participants. The self-efficacy scale used in the current study was developed by Bandura (2006a), who advocated against likert-style options. Bandura proposed a 0-100 scale because he felt as though likert-style response options limited a person's ability to effectively convey self-efficacy levels. However, given the emergent popularity of mobile technology and Tang and colleagues (2015) findings that people are more likely to engage in mobile-based activities if they are easy to use, future researchers may decide against using surveys with responses that require more than selecting an answer.

Mobile Fitness App Support Scale

Six questions were developed to examine mobile fitness app support as a predictor of physical activity because a reliable and valid instrument does not exist. Given the nature of mobile technology, a reliable and valid instrument may not be possible for the foreseen future, which may limit the current and future research findings. Mobile technology is constantly evolving, which can be seen in the fact that Apple, a leader in the smartphone industry, has released 13 iterations of the iPhone in the past eight years (Apple Inc., 2016). The evolution of

myfitnesspal provides a good example of how mobile fitness app technology is also constantly evolving. What began as a simple meal-tracking website in 2005 is now a mobile fitness app that features a personal fitness diary, a social media component, a database of exercises, and data integration with fitness devices and other fitness apps (Orin, 2014). In fact, due to the evolution of technology, more than 20 updates were released for the myfitnesspal app in 2015 alone (MyFitnessPal LLC, 2015). Similar to how Bandura (2006a) has hypothesized that self-efficacy is an ever-evolving construct, support provided by mobile fitness apps may be just as elusive. For example, the six questions used to examine mobile fitness app support in the current study may not have been applicable in 2009 when myfitnesspal released the first version of the app. Therefore, it may not be possible to have a single validated instrument to assess mobile fitness app support; therefore, future researchers should make adjustments as needed to consider any new technological features added to mobile fitness app platforms.

Data Conversion

Factor analyses were used to provide rationale for reducing the 18-item self-efficacy scale and the 6-item mobile fitness app support scale into single factor variables. The data conversion process also included creating categories to represent levels of self-efficacy and mobile fitness app support. Existing literature has argued that dichotomizing continuous variables may result in a loss of depth and understanding of data (Altman & Royston, 2006); in the same way, creating categories to represent low, moderate, and high levels of self-efficacy and mobile fitness app support may have resulted in a similar loss of depth. For example, participants with factor scores between -1 and -0.01 were labeled “low self-efficacy” and factor scores from 0 and 0.99 were labeled “moderate self-efficacy. Despite the fact that Bandura’s (2006a) recommendations were considered in the development of the categories, it is possible that a

participant with a factor score of 0.01 had more in common with a participant with a factor score of -0.01 than a participant with a factor score of 0.99. Thus, future research should include further exploring the commonalities of observations falling at extreme ends of cutoff points.

Conclusion

Technology is nothing. What's important is that you have faith in people, that they're basically good and smart, and if you give them tools, they'll do wonderful things with them. – Steve Jobs.

Social cognitive theory was used as a theoretical foundation for the current study. The results of the study have upheld claims made in previous research that self-efficacy is the strongest predictor of physical activity. Indeed, self-efficacy was the only independent variable that met statistical significance in all four models. The results have also provided support for the growing body of literature suggesting that social support systems are significant predictors of physical activity. In fact, when compared to the other independent variables, peer support had the greatest impact on muscle strength training and physical activity at vigorous intensities.

Technology has changed the way people live. Social media is an emergent technology that has captivated people and changed the way they express themselves, gather knowledge, and communicate with others. Thus, the scientific community is obligated to conduct research to explore the effects of this emergent phenomenon. The current study has enhanced the scientific understanding of what motivates people to participate in physical activity by including a measure of mobile fitness app support, which was found to be significant in three of the four regression models. The implications of this study provide researchers with a foundation for future research to further explore the impact of mobile fitness apps, but also to explore other utilizations of mobile support platforms.

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APPENDIX A: IRB APPROVAL

ACTION ON EXEMPTION APPROVAL REQUEST



TO: Steven Maberry
Social Work

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: September 24, 2015

RE: IRB# E9505

TITLE: Examining the Social Media Component of Mobile Fitness Apps on Physical Activity Behavior

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

New Protocol/Modification/Continuation: New Protocol

Review Date: 9/24/2015

Approved X **Disapproved** _____

Approval Date: 9/24/2015 **Approval Expiration Date:** 9/23/2018

Exemption Category/Paragraph: 2a,b

Signed Consent Waived?: Yes

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable)

By: Dennis Landin, Chairman 

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. **SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc.**

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at <http://www.lsu.edu/irb>*

APPENDIX B: ONLINE SURVEY



You are being invited to participate in a research study to explore the various mechanisms that motivate people to be physically active. This study is being conducted by Steven Maberry to fulfill the requirements for a PhD from Louisiana State University.

If you choose to participate, you will be asked to complete an online survey. This survey will cover topics like 1) your physical activity levels, 2) your social support systems, and 3) mobile fitness apps. It will take you approximately 15 minutes to complete the survey.

You may not directly benefit from this research; however, the findings may assist in the development of interventions to promote physical activity and healthy lifestyles.

There are no known risks associated with participating in this research study. The study does not ask for your name or any identifiable information. Your computer, email address, and social media accounts will not be connected to the answers you provide on your survey. Efforts will be made to keep your study-related information confidential. However, there may be circumstances when, required by law, this information must be released.

If you have questions about this study or if you have a research-related problem, you may contact the researcher, Steven Maberry, at smaber1@lsu.edu, or any member of the research committee (Dr. Priscilla Allen, pallen2@lsu.edu; Dr. Cecile Guin, cguin@lsu.edu; Dr. Wesley Church II, wesleyc@lsu.edu; Dr. Judith Rhodes, jrhode9@lsu.edu). If you have any questions concerning your rights as a research subject, you may contact Dr. Dennis Landin at the LSU Institutional Review Board: 225-578-8692, irb@lsu.edu, www.lsu.edu/irb.

By clicking "I agree" below you are indicating that you are at least 18 years old, have read and understood this consent form, and agree to participate in this research study. Please print a copy of this page for your records.

I Agree

Control Variables

With what gender do you identify?

☐ Male

☐ Female

☐ Gender Non-Conforming

With what race/ethnicity do you identify?

☐ Black/African American

☐ White

☐ Asian/ Pacific Islander

☐ Hispanic/Latino

☐ American Indian

☐ Other_____

What is your highest level of education?

☐ Less than a HS Diploma

☐ HS Diploma/GED

☐ Some College

☐ 2 or 4 year degree

☐ Master's Degree

☐ Doctorate
(PhD, EdD, JD, etc)

☐ Other_____

How old are you?

(dropdown menu)

Physical Activity

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

During the last 7 days, on how many days did you do vigorous physical activities like aerobics, or fast bicycling? _____

How much time did you usually spend doing vigorous physical	Hours	_____
activities on one of those days? (hours and minutes, don't know)	Minutes	_____

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

During the last 7 days, on how many days did you do moderate physical activities like bicycling at a regular pace, or doubles tennis? _____

How much time did you usually spend doing moderate physical	Hours	_____
activities on one of those days?	Minutes	_____

During the last 7 days, on how many days did you do muscle strengthening activities, such as squats or triceps extensions? _____

Self-Efficacy

A number of situations are described below that can make it hard to stick to an exercise routine. Please rate in each of the blanks in the column how certain you are that you can get yourself to perform your exercise routine regularly (three or more times a week).

Rate your degree of confidence by recording a number from 0 to 100

	Confidence (0-100)
When I am feeling tired	_____
When I am feeling under pressure from work	_____
During bad weather	_____
After recovering from an injury that caused me to stop exercising	_____
During or after experiencing personal problems	_____
When I am feeling depressed	_____
When I am feeling anxious	_____
After recovering from an illness that caused me to stop exercising	_____
When I feel physical discomfort when I exercise	_____
After a vacation	_____
When I have too much work to do at home	_____
When visitors are present	_____
When there are other interesting things to do	_____
If I don't reach my exercise goals	_____
Without support from my family or friends	_____
During a vacation	_____
When I have other time commitments	_____
After experiencing family problems	_____

Mobile Fitness App Support

Many mobile fitness apps have a social media component embedded within them. For example, the ability to share your workout, diet, thoughts, or photos. Social media components of mobile fitness apps may also be used as a forum for asking questions and receiving feedback on ideas.

The following questions are about your experiences with the social media components of your mobile fitness apps.

Possible Responses: “never,” “rarely,” “sometimes,” “often,” and “very often”.

How often do you view the social media components embedded within mobile fitness apps? (For example, logging on specifically to see what has been posted by others)

How often do you participate in the social media components embedded within mobile fitness apps? (For example, interacting with others on a post or forum)

I use the social media component of my fitness apps to further educate myself (for example, viewing forums or asking questions)

I have met, in person, the people I communicate with on my mobile fitness app(s).

I compare my own workouts to that of my friends.

Possible Responses: “not at all like me,” “not like me,” “not much like me, neutral,” “somewhat like me,” “like me,” and “just like me”

Interacting with people through my mobile fitness app motivates me to continue participating. (For example, comments left from friends and liking photos)

Peer and Family Support

Please circle your answers once for family and once for friends for each of the following statements.

Possible Responses: “never”, “rarely”, “sometimes”, “often”, and “very often”

During the past three months my family or friends:

Did physical activity with me	Friends	_____
	Family	_____
Offered to do physical activity with me	Friends	_____
	Family	_____
Gave me encouragement to do physical activity	Friends	_____
	Family	_____

Significant Other’s Physical Activity

Possible Responses: “never”, “rarely”, “sometimes”, “often”, and “very often”

My significant other often plays sports or does something active. _____

My significant other and I do active things together. _____

APPENDIX C: SOCIAL COGNITIVE THEORY FOR PHYSICAL ACTIVITY



VITA

Steven Maberry was born in Tulsa, Oklahoma. He received a Bachelor of Arts degree in Music Technology from Oral Roberts University; a Master of Science in Education, specializing in Rehabilitation Counseling, from Hunter College; and a Master of Science in Kinesiology from Louisiana State University. Steven is a Certified Rehabilitation Counselor and a Certified Performance Enhancement Specialist. Steven lived and worked in New York City for 10 years prior to moving to Baton Rouge to pursue a PhD. Steven's employment history includes working in addiction treatment, workforce development, and with youth in the South Bronx who had aged out of the foster care system.